This manual has been scanned by the

Vickers MG Collection & Research Association

www.vickersmg.org.uk

Please support the work of the Association.

Click on the image to donate through PayPal:

Or regularly support us through Patreon:

A not-for-profit company, limited by guarantee, registered in England, Company Registration Number 07855202

THE BIG TIME

[Crown copyright reserved.

July, 1923.

40
W.O.
8721

RANGE TABLE

OF THE

'303-INCH VICKERS MACHINE GUN.

1923.

A.O.308. 1923. **Machine Gun Training—Annual Machine Gun Course.**—1. Os.C. regular cavalry and infantry units at home will render to the G.O.C.-in-C. the command, within 14 days of the conclusion of the weapon training year, Army Form B 192M in triplicate, through brigade and divisional (or equivalent) commanders, who will add their remarks. The G.O.C.-in-C., after entering his remarks, will send one copy to the Commandant, Machine Gun School, Netheravon, return one copy to the unit, and retain one copy.

(755

No. 103. Target for the Annual Machine Gun Course.

1924, is

ne Gun
to make
may be

e targets
on both

used in
e inches
ey paper
ced with

dated 29th

ourse.-

of 1924.

Practice
ico 14 with white or grey paper. It is
no account may this target be outlined
only alteration that may be made to the
sual difficulties is that given in the
ted above."

Target used in Practice
pointed out that on no
in this manner. The only
target to obviate visual
India Army Order quoted

Targets
the Ann
Machine
Gun
Course.

A.O.280. 1922. **Equipment Regulations, Part 1—Amendments.**— 1. *For* paragraphs 207 and 208 (as amended by Army Order 574 of 1920) *substitute*—

Notes on the use of the Work Chart Programmes

kept up punctually - and periodically arrange classes for those
missed subjects through duties in sickness etc.

with body, band, inner, &c., will also be considered equivalent to one rifle.

etail.

ale on service.

[*Crown copyright reserved.*

July, 1923.

40
W.O.
8721

RANGE TABLE

OF THE

'303-INCH VICKERS MACHINE GUN.

1923.

A.O.308. 1923. **Machine Gun Training—Annual Machine Gun Course.**—1. Os.C. regular cavalry and infantry units at home will render to the G.O.C.-in-C. the command, within 14 days of the conclusion of the weapon training year, Army Form B 192M in triplicate, through brigade and divisional (or equivalent) commanders, who will add their remarks. The G.O.C.-in-C., after entering his remarks, will send one copy to the Commandant, Machine Gun School, Netheravon, return one copy to the unit, and retain one copy.

(755

CONTENTS.

Range Table . . . . . .
Minimum Clearances and Safety Angles, Overhead Fire
Table, Influence of Ground upon Beaten Zones .
Graph of Allowances for Climatic Variations . .
V. I. Graph . . . . . .
Chart, for Firing Up or Down Hill . . . .
Trajectory Graph . . . . . .

[*Crown copyright reserved.*

July, 1923.

40
W.O.
8721

RANGE TABLE

OF THE

·303-INCH VICKERS MACHINE GUN.

1923.

CONTENTS.

	PAGE
Range Table	1
Minimum Clearances and Safety Angles, Overhead Fire ...	2
Table, Influence of Ground upon Beaten Zones	3
Graph of Allowances for Climatic Variations	4
V.I. Graph	5
Chart, for Firing Up or Down Hill	5
Trajectory Graph	6

(755)

RANGE TABLE.

·303 *Vickers gun, Mark VII. ammunition.*

1	2	3		4	5	6		7
Range (Yards).	Tangent angle.	Slope of descent.		Height in Yards of Lowest Shot below Centre of Cone.	Height of Cone in Yards.	Dimensions in Yards of Horizontal Beaten Zones.		Time of Flight (Seconds).
		In Minutes.	As a Gradient. One in			Width.	Length.	
100	3′	—	—	—	—	—	—	—
200	7′	—	—	·7	—	—	—	·2
300	11′	—	—	1·0	—	—	—	·4
400	16′	15′	230	1·3	—	—	—	·6
500	22′	23′	149	1·7	3·3	2·3	700	·8
600	28′	32′	107	2·0	4·0	2·8	600	1·0
700	35′	42′	82	2·3	4·6	3·3	525	1·25
800	43′	54′	64	2·7	5·3	3·8	450	1·5
900	52′	1° 9′	50	3·0	6·3	4·3	375	1·75
1000	1° 2′	1° 28′	39	3·3	7·3	5·0	300	2·0
1100	1° 13′	1° 51′	31	4·0	8·3	6·0	270	2·3
1200	1° 26′	2° 19′	25	4·7	9·6	7·0	240	2·65
1300	1° 41′	2° 52′	20	5·3	11·0	8·0	210	3·0
1400	1° 57′	3° 29′	16	6·0	12·6	9·0	180	3·4
1500	2° 15′	4° 11′	14	6·7	14·3	10·0	160	3·8
1600	2° 35′	4° 58′	12	7·3	16·3	11·3	150	4·2
1700	2° 57′	5° 50′	9·8	8·0	18·6	12·7	145	4·7
1800	3° 21′	6° 47′	8·5	8·7	21·3	14·0	140	5·2
1900	3° 47′	7° 49′	7·3	9·3	24·0	15·3	135	5·8
2000	4° 16′	9° 1′	6·4	10·0	27·3	16·7	130	6·4
2100	4° 48′	10° 23′	5·5	13·3	31·3	18·0	140	7·1
2200	5° 22′	11° 55′	4·8	16·7	36·0	19·3	150	7·8
2300	6° 0′	13° 37′	4·2	20·0	42·0	20·7	160	8·6
2400	6° 41′	15° 29′	3·7	25·0	50·0	22·0	170	9·5
2500	7° 27′	17° 32′	3·3	30·0	59·0	23·3	180	10·5
2600	8° 16′	19° 46′	2·9	35·0	70·0	25·0	190	11·7
2700	9° 11′	22° 12′	2·6	41·7	83·0	26·7	200	13·0
2800	10° 10′	24° 51′	2·3	48·3	96·0	28·3	210	14·4

(R.T. 296) 20000 7/23 W.O.P. 755

Overhead fire.

Range to our own troops.	Minimum clearance.		Safety angle.
	yards.	metres.	° ′
600 yards	11	10	1 30
700 „	13	12	1 38
800 „	15	14	1 47
900 „	17	16	1 57
1,000 „	20	18	2 10
1,100 „	23	21	2 24
1,200 „	27	25	2 42
1,300 „	31	28	3 2
1,400 „	35	32	3 22
1,500 „	40	37	3 46
1,600 „	46	42	4 13
1,700 „	53	48	4 43
1,800 „	60	55	5 14
1,900 „	69	63	5 50
2,000 „	80	73	6 32

NOTE.—The column headed "Safety angle" in the table given above will not be made use of until after the publication of the revised edition of "Machine Gun Training" now in course of preparation.

The revised edition will contain full explanation of the method of application of these safety angles.

Meanwhile, the methods of overhead fire given in the 1921 (Provisional) edition of "Machine Gun Training" will continue in force.

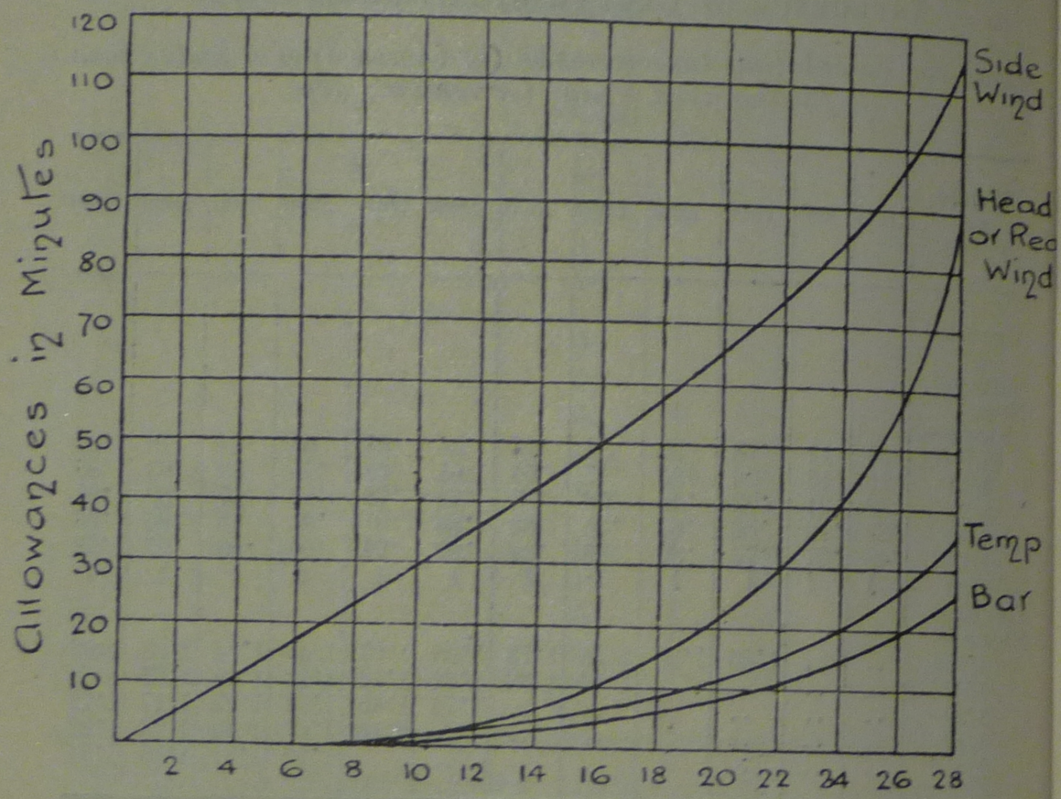
INFLUENCE OF GROUND UPON BEATEN ZONES.

Table for calculating the reduction (or increase) of a beaten zone falling upon a near (or reverse) slope.

Range in yards	600	800	1000	1200	1400	1600	1800	2000	2200	2400	2600	2800
Gradient of Ground.												
Near Slope—												
1/8·5	·07	·12	·18	·28	·38	·48	·54	·61	·68	·74	·79	·82
1/12	·10	·16	·26	·36	·47	·54	·61	·68	·75	·80	·83	·86
1/20	·18	·21	·32	·46	·59	·67	·72	·78	·83	·87	·89	·91
1/50	·30	·40	·56	·67	·78	·82	·86	·91	·94	·95	·96	·96
1/100	·48	·61	·73	·80	·85	·89	·92	·94	·95	·96	·97	·98
Flat	1	1	1	1	1	1	1	1	1	1	1	1
Reverse Slope—												
1/100	..	..	1·60	1·30	1·20	1·13	1·09	1·07	1·05	1·04	1·03	1·02
1/50	..	..	..	..	1·50	1·33	1·22	1·16	1·13	1·09	1·07	1·06
1/20	..	..	..	..	..	..	1·74	1·45	1·32	1·22	1·17	1·12
1/12	..	..	..	..	..	..	..	2·13	1·67	1·42	1·28	1·22
1/8·5	..	..	..	..	..	..	..	..	2·22	1·81	1·45	1·34

Example (near Slope).—Range, 2,000 yards; gradient of near slope on which the shots are falling, is found to be 1 in 20: the beaten zone at 2,000 yards is 130 yards long; from the table, the factor in the vertical column under "2,000," opposite "near slope $\frac{1}{20}$" is 0·78. The beaten zone on the slope will be 130 × 0·78 = say, 100 yards.

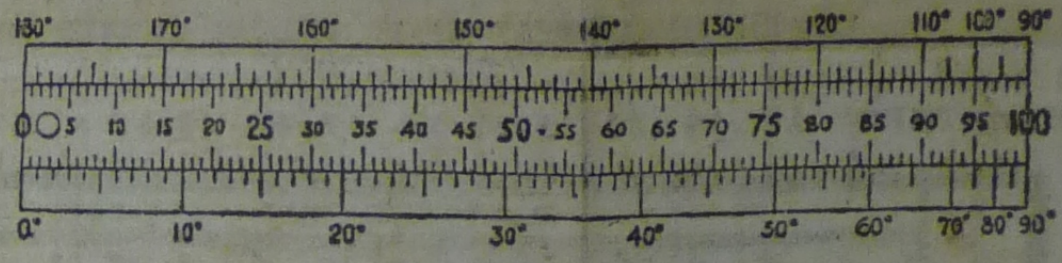
GRAPH OF ALLOWANCES FOR CLIMATIC VARIATIONS.



Range in Hundreds of Yards.

Side wind curve
Head or rear wind curve } are for 20 miles an hour wind.
Temperature curve is for a variation of 20° from normal (60° F.).
Barometer curve is for a variation of 1 inch from normal (30 inch).

Scale for the conversion of OBLIQUE bases to TRUE bases.
Example :—Base 80x long at an angle of 125°.
From scale, 75°/. of oblique base equals true base, which is 60x.



V. I. GRAPH.

The Angle is shewn by the diagonal line nearest to the point of intersection of the required base line (vertical) and the (horizontal) Range line.

Note.—Both base and Range must be taken in the same unit of measure: *e.g.*, both in yards or both in metres.

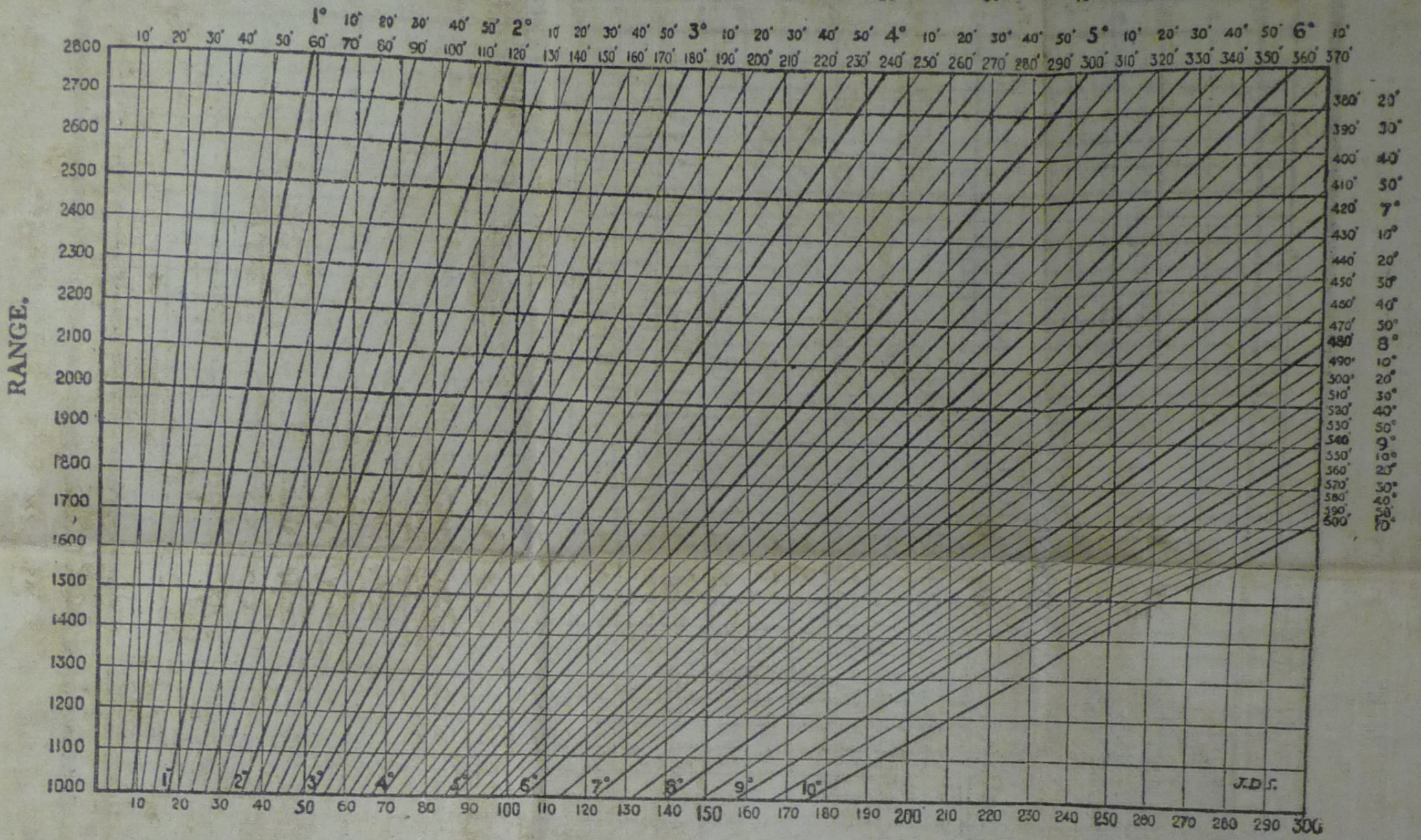
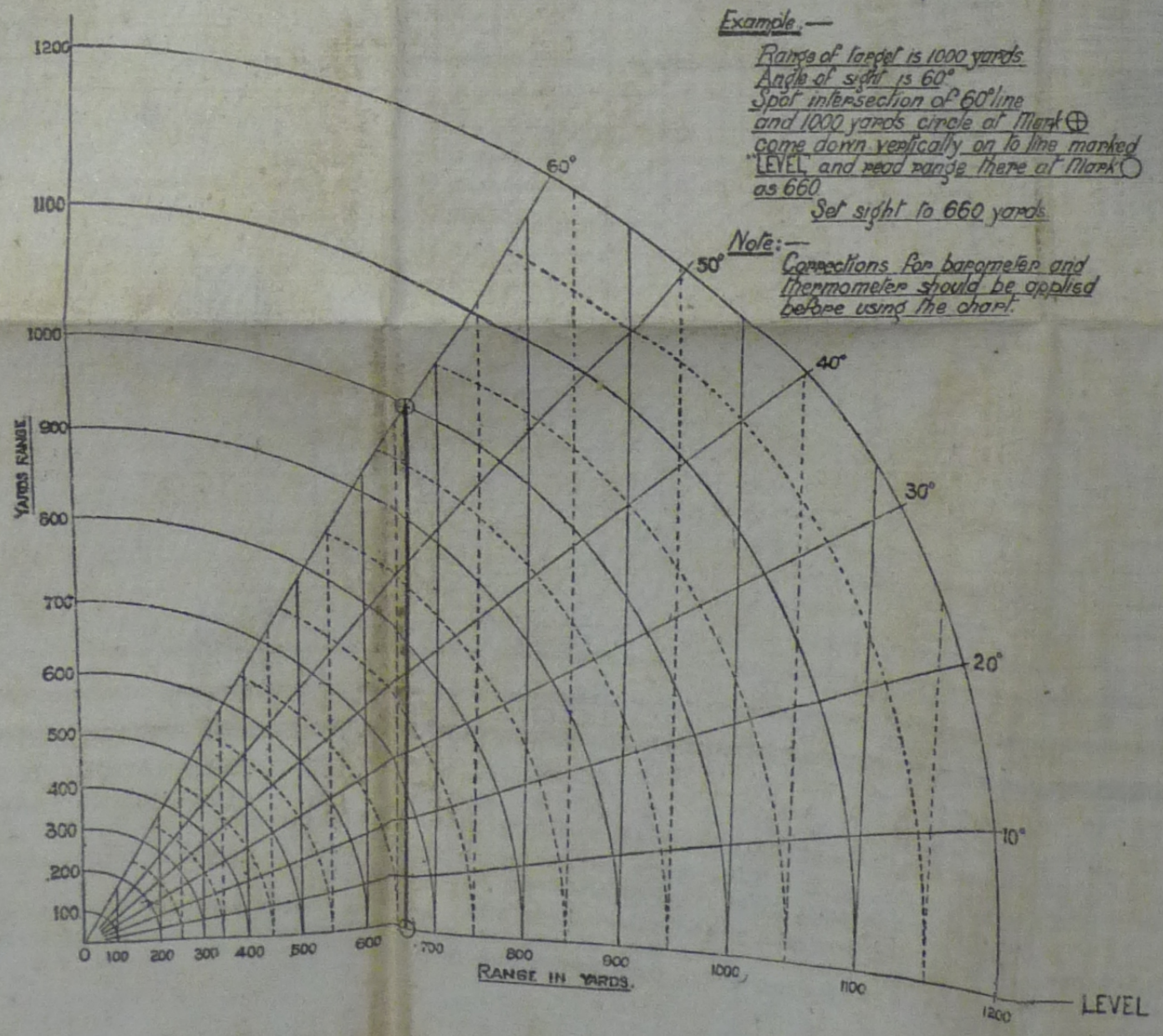
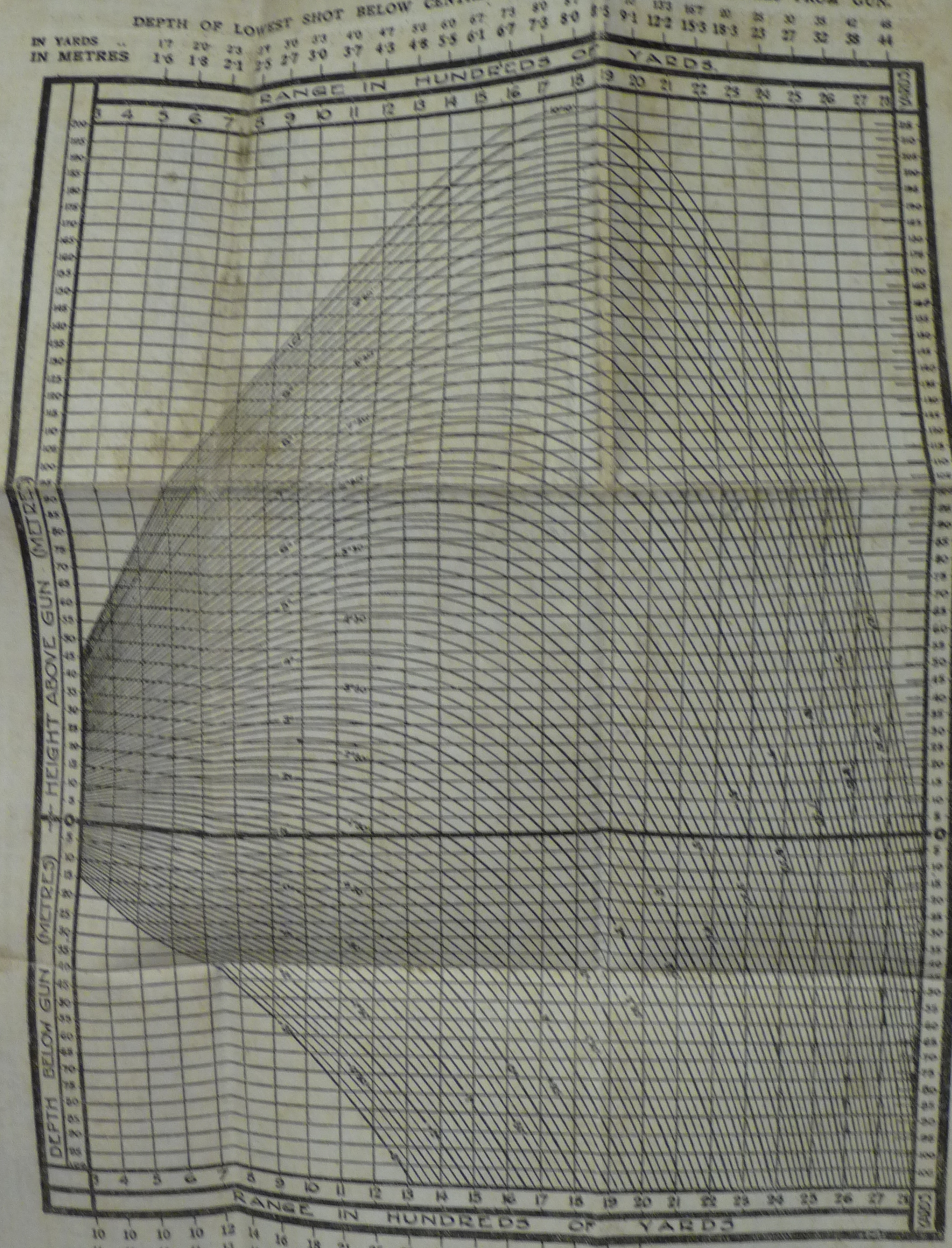


CHART FOR ·303 MARK VII FOR FIRING UP OR DOWN HILL.



Graph for Calculating Quadrant Elevation (Angle of Fire) and Clearances.

(CURVES REPRESENT CENTRE SHOTS.)



How to Use the Graph.—To Find Q.E.: Take range and run up on vertical scale to height of target above or below gun. The curve cutting this point gives required Quadrant Elevation.

To Find Clearance.—Follow this curve along, and ascertain at what height it passes vertically above a point plotted to show distance and height (above or below gun) of own troops (or obstruction). This gives clearance in yards (right-hand scale), or metres (left-hand scale), from centre shot to ground.

(a25/660)x 20m 8/23 H & S Ltd. Gp. 25

603

1st July 1924.

603. Scale of Vickers gun equipment for cavalry and infantry units in India.

The following amendments are made to the Appendix to Army Instruction (India) No. 240 of 1923 :—

After item No. 31, below 'Section 15-B.' *insert* in the first four columns respectively :—

1	2	3	4
31-A.	Cases, clinometer, Vickers' ·303", gun, Mark II.	1 per 2 guns.	1 per 2 guns.

Against item No. 33 in columns 3 and 4 *for* 1 per unit, *read* 1 per 2 guns.

Delete item No. 51 and all connected entries.

2. Indents to complete units to the scale of clinometers and cases will be called for by chief ordnance officers when the stores become available. Levels, spirit, will be returned to the Indian Army Ordnance Corps as soon as the full scale of clinometers, Vickers gun, is received.

[2974 (M. G. S.-2-B). / A-II.]

No. 168. Targets for the Annual Machine Gun Course.

The following extract from India Army Orders, dated 3rd March 1924, is published for information:—

No. 169. Targets for the Annual Machine Gun Course.

With reference to Section 38, Description of targets, "Machine Gun Training 1921" it is notified that if the local conditions are such as to make it difficult for the firer to see the target, the following modifications may be made:—

(*a*) White paper may be used instead of grey for outlining the targets used in application practices and for the horizontal band on both application and traversing targets.

(*b*) A six inch horizontal band may be pasted on the target used in Practice 14. The bottom of this band will be twelve inches from the bottom of the target. This band may be of grey paper if the target is faced with brown, and of white if faced with grey paper.

Targets for the Annual Machine Gun Course.

The following extract from India Army Orders, dated 29th March 1924, is published for information:-

"No: 250. Targets for the Annual Machine Gun Course.-

Reference India Army Order No: 169 of 1924.

It has come to notice that certain units are outlining the target used in Practice 14 with white or grey paper. It is pointed out that on no account may this target be outlined in this manner. The only alteration that may be made to the target to obviate visual difficulties is that given in the India Army Order quoted above."

Notes on the use of the Work Chart, Programmes of Work, and Allotment Table.

1 The meaning of the abbreviations used in the programmes can be got from Cols. 1 & 2 of the Work Chart.

2 The numbers in the programmes refer to those at the tops of columns in the Work Chart: where not otherwise stated the numbers under subjects in col. 1 of Work Chart refer to "Handbook".

3 Only three periods a day are given: this is to allow for education, necessary regimental routine, physical training, quinine parades and so on. The allowance of three periods per diem was arrived at as a probable average of work that can be done by a V. G. unit in a Regiment. Some adjustment will be inevitable. As an example – The Battalion route marches every Monday, perhaps: but does its education in the afternoons: so the V. G. Officer fits in his lost Monday periods on three days each week 11-30 to 12-15: and adjusts the numbering to get the correct sequence.

4 No allotment is made for Lectures: this is because these will be best arranged by the V. G. Officer himself, who will find ways of fitting in an odd 25 mins. here and there for this purpose.

5 The Allotment Table is given, as it is convenient to refer to when calculating the state of training: periods in certain subjects may have been lost through various causes, and a "cross – tot" of this table will make it easy for the V. G. Officer to see what subjects need pushing forward to get a level finish in the following week.

6 The Work Chart shows technical instruction only. The complete Vickers Gunner has to have instruction in a variety of minor, but important, subjects as well. For those who have done a course at the M. G. School, see printed headings of Lecture on "Training of V. G. personnel" (Now lecture No. XV) list of these subjects in para 3. A subsidiary Work Chart, on similar lines to the above, should be maintained for these subjects, and for all advanced training. They would be taught mainly after the eight weeks course had been completed, but could be introduced earlier as opportunity offered.

7 After the 8 weeks course is completed, whether by men who knew nothing of the Gun before, or by partially instructed personnel, they are still recruits at Vickers Gun work, and should be taken on by easy stages:—

(a) Being perfected at the work already done.

(b) Being initiated into and practised in elementary, and later, advanced tactical handling.

(c) Learning the more advanced machine gunnery.

8 Keep a Training Chart – which will show exactly what periods every individual has completed. Enter up day by day – it is very little trouble if kept up punctually – and periodically arrange classes for those who have missed subjects through duties in sickness etc.

A.O.280. 1922. Equipment Regulations, Part 1—Amendments.—1. For paragraphs 207 and 208 (as amended by Army Order 574 of 1920) *substitute*—

with body, band, inner, &c., will also be considered equivalent to one rifle.

A.O.280. 1922. **Equipment Regulations, Part 1—Amendments.**— 1. *For* paragraphs 207 and 208 (as amended by Army Order 574 of 1920) *substitute*— 77 6 517

A.O. 280. 1922.

207.—(*a*) Vickers ·303-inch machine guns forming part of the war equipment of regular units will be provided with four barrels, including the one in the gun, viz. :—

(i) Two new barrels distinguished by a band of white paint round the centre, to be kept in mobilization store and taken into use on mobilization, one in the gun and one as spare.

(ii) One serviceable barrel for use in peace, for ball firing only ; to be returned to store on mobilization.

(iii) One D.P. barrel for use in peace for drill purposes, or for firing blank only ; to be returned to store on mobilization.

Vickers ·303-inch machine guns not used in peace should not be provided with barrels under (ii) and (iii).

(*b*) Lewis and Hotchkiss ·303-inch machine guns forming part of the war equipment of regular units will be provided with five barrels, including the one in the gun, viz. :—

(i) Two new barrels distinguished by a band of white paint round the centre, to be kept in mobilization store and taken into use on mobilization, one in the gun and one as spare.

(ii) Two serviceable barrels for use in peace, for ball firing only ; to be returned to store on mobilization.

(iii) One D.P. barrel for use in peace for drill purposes, or for firing blank only ; to be returned to store on mobilization.

Lewis and Hotchkiss ·303-inch machine guns not used in peace should not be provided with barrels under (ii) and (iii).

208.—(*a*) Vickers ·303-inch machine guns held on armament charge will have—

(i) One mobilization barrel.
(ii) and (iii) As in para. 207 (*a*) (ii) and (iii).

(*b*) Lewis ·303-inch machine guns held on armament charge will have—

(i) One mobilization barrel.
(ii) and (iii) As in para. 207 (*b*) (ii) and (iii).

57 Gen. No. 4806

2. *For* paragraph 495 *substitute*— A.O. 192 *contin*

495. When browning of any components of rifles is carried out, as the result of inspection by viewers of the Inspection Department, two sets of components (exclusive of barrels, with body, band, inner, &c.) will be considered equivalent to one rifle. Two barrels, with body, band, inner, &c., will also be considered equivalent to one rifle.

WORK CHART.

Perid / Subjet	Abbreviation	No. 1	No. 2	No. 3	No. 4	No. 5			No. 6	No. 7	No. 8	No. 9	No. 10	No. 11	No. 12
Elementary Gun Drill prov. 1920	E.G.D.	Paras. 2. 3. 4. and 5.	Manipulation of Tripod.	Paras. 6. 7. & 8.	Paras. 9 & 10	Paras. 11. 12. & 13.			Paras 14. 15. & 16.	Para. 17.	Para. 18.	Para 19.	Para 21.	Para 21.	Revision.
General Description. ·303 handbok	G. Desc	Non-Recoiling Barrel Casing	Portions Breech Casing	Recoiling Portions & Feed Block.	Tripod & Revise.										
Stripping.	Strip.	Gun.	Lock	Gun & Lock. Revision.	Gun & Lock Revision.										
Aiming Instruction. prov. 1920.	A I.	Whole.	Whole	Whole.	Whole										
Immediate Action. 85.	I. A.	General & 1st. Position	2nd Position.	3rd. Position	4th. Position	3rd. Position			1st, 2nd. Positions 4th.	1st 2nd Positions. 4th	3rd Position	All			
Mechanism Page 41. ·303 handbook	Mech.	To Load. To Fire. To Unload	Recoil.	1st. Action in Feed Block	Backward Rotation of Crank.	Backward Rotation of Crank.			2nd. Action. in Feed Block.	Backward. Movement of the Lock.	Cocking of Lock.	Action of Fusee Spring & For-ward Rotation.	Action of Fusee Spring & Forward Rotation,	Firing First Shot. Firing Subsquent. Release of Pressure.	Revise 11th Lesson. Mech. 17 Revise all Lessons.
Care and Cleaning 56	C. & C	Sub heads 1-5 and 7–11.	Sub-head 6												
Belt Filling 101.	B. F.	Singly and Belt Filling Machine	Four to a Belt.												
Points, Before, During & After Firing 75.	B. D. A.	Whole.	Whole.												
Repairs & Adjustments. 108.	R. & A.	From Commencement to weighing Recoiling Portions	Testing Length of Connecting Rod, to End.												
Instruction in use of Packs	Pack.	Saddlery Stripped.	Assembling of saddlery.	Fitting of Saddlery.	Lading.	Pack Drill			Pack Drill	Pack Drill.	Into & Out of Action from Packs	Into & Out of Action from Packs.			
Test of Elementary Training prov 1920	T. O. E. T.	Practice.	Trial Run	Trial Run	For passing out.	For Passing out.			* Refresher.	* Refresher.					
Annual Machine Gun Course, Part I. Instructional & all Shooting on 25 yds Range.	25 yds.	Grouping Trial Run	Traverse & Search Trial Run.	‡ Part 1 Practice 1.	Part 1 Practice 1	Part 1 Practices 2 and 3.			Part 1 Practices 2 and 3	Part 1 Practices 2 and 3	Part 1 Practices 2 and 3	Part 1 Practice 4	Part 1 Practice 4	Part 1. Practice 5	Part Practice
Spare Parts 80	S. P.	Whole	Whole												
Advance Gun Drill. prov. 1920	A. G.D.	Paras 2 & 3.	Paras 4 & 5	Paras 7 & 8											
Stoppages. 95.	Stop.	1st. Position.	2nd. Position.	3rd. Position.	4th. Position.	3rd. Positions			2st. 1nd. Position. 4th.	1st. 2nd Positions 4th.	3rd Position.	All.			

* Tests 1 – 6 in each case.

‡ Note." Part 1. "Paras" Annual Machine Gun Course Part 1, Instructional.

Allotment Table.

Week. SUBJECT.	1 st. week.	2nd week.	Total. to Date.	3rd. week.	Total.	4th week	Total.	5th week.	Total.	6th week.	Total	7th. week	Total.	8th. week.	Total.
E. G. D.	5	4	9	3	12	3	15	4	19	2	21	0	21	0	21
G. Desc.	3	1	4	0	4	0	4	0	4	0	4	0	4	0	4
Strip.	3	1	4	0	4	0	4	0	4	0	4	0	4	0	4
A. I.	2	1	3	1	4	0	4	0	4	0	4	0	4	0	4
I. A.	1	2	3	2	5	2	7	2	9	1	10	1	11	1	12
Mech.	1	2	3	3	6	2	8	3	11	5	16	3	19	2	21
C. &. C.	0	2	2	0	2	0	2	0	2	0	2	0	2	0	2
B. F.	0	1	1	0	1	0	1	1	2	0	2	0	2	0	2
B. D. A.	0	1	1	1	2	0	2	0	2	1	3	0	3	0	3
R. &. A.	0	0	0	1	1	0	1	1	2	0	2	0	2	0	2
Pack	0	0	0	2	2	1	3	1	4	1	5	2	7	2	9
T. O. E. T	0	0	0	0	0	5	5	0	5	0	5	1	6	1	7
25 Yds.	0	0	0	2	2	2	4	2	6	2	8	2	10	2	12
S. P.	0	0	0	0	0	0	0	1	1	1	2	0	2	0	2
A. G D.	0	0	0	0	0	0	0	0	0	2	2	2	4	2	6
Stop	0	0	0	0	0	0	0	0	0	0	0	4	4	5	9
	15	15	30	15	45	15	60	15	75	15	90	15	105	15	120

GRAPH of TRAVERSES, etc.

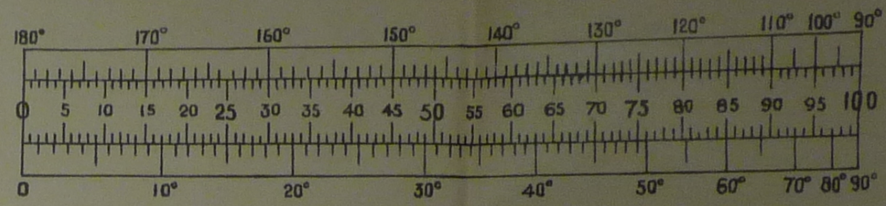
(IN YARDS OR METRES AND DEGREES)

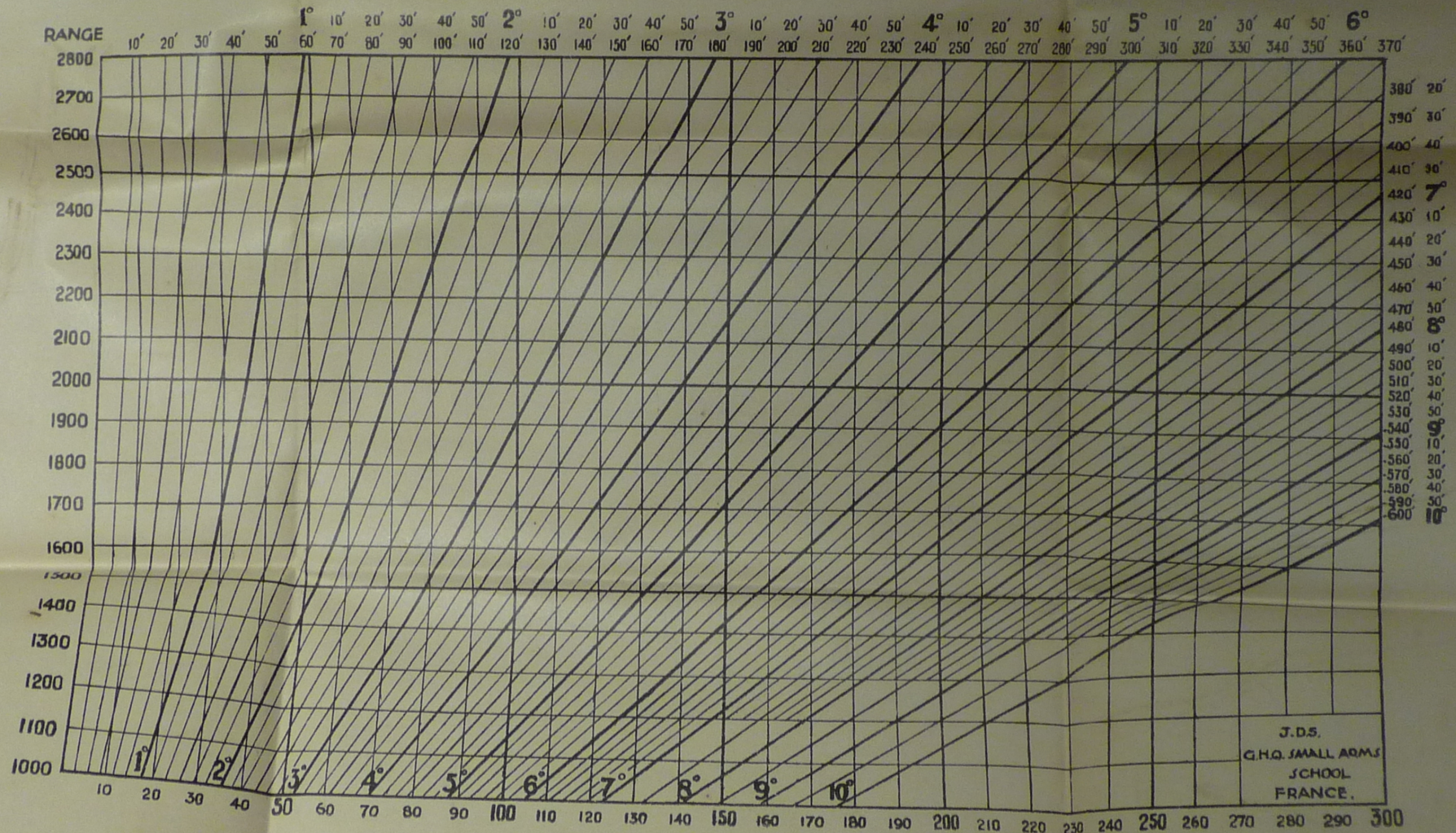
The angle is shewn by the diagonal line nearest to the point of intersection of the required (vertical) Target-Frontage line and the (horizontal) Range line.

NOTE:- *Both Target-Frontage and Range must be taken in the same unit of measure: e.g: both in yards or both in metres.*

SCALE FOR THE CONVERSION OF OBLIQUE TO EQUIVALENT FRONTAL TARGETS

Example:- Target 280" long at angle of 150° to the line of fire.
The scale gives ·45 so equivalent frontal target = ·45 of 280" = 126"





TARGET FRONTAGE

Extract from specimen page of suggested Training Chart.

FIRST WEEK.

Regtl. No.	Rank.	Name	E. G. D.	G. Desc.	Stripp.	A. I.	I. A.	Mech.
010101	L/Cp.	Leather H. F.	I. I. X. I. X.	I. I. I.	X. I. X.	I. X.	I.	I.
121212	Pte.	Full B.	X. I. I. X. I.	I. X. X.	X. I. I.	I. I.	X.	X.

NOTE:— Reference the above EXTRACT and the Allotment Table:—

The above system entails making out eight pages for the Course where the man has done a period he is marked up with a I where he has missed with a X.

A ninth is then necessary in which the totals week by week can be entered up. In this way the Machine Gun Officer can tell at a glance how many periods any particular man has completed in any one subject.

He can then arrange times for bringing these men up to date, grouping those men who have missed the same subjects under one N.C.O. instructor or some L/Cpl. who is not quite good enough on the gun to be an instructor in the ordinary way, but who is good at teaching some minor subject. This incidentaly helps on the L/Cpl. who needs experience in instructing, and confidence, to become an efficient instructor.

By having "Picking – up days" and by the use of a little ingenuity the V. G. Officer can bring the training up to date for **every single man.**

Without some system of this sort no V. G. Officer can keep any real Account of how his training is going. It is the detailed check which produces the polish: and the polish turns

scale on service.

2a.

40/WO/5794,
'/7690
S.S. 221.

MACHINE GUN TRAINING.

PART I.—TRAINING.

ISSUED BY THE GENERAL STAFF, FEBRUARY, 1919.

NOTE.—Machine Gun Training, Part II, will be embodied in the new Machine Gun Training and will not be issued as a separate publication.

This Manual cancels Infantry Machine Gun Company Training and is to be used in conjunction with The Tactical Employment of Machine Guns and The Handbook for the ·303-in. Vickers Machine Gun.

(Reprinted, with Amendments, June, 1920).

LONDON:
PRINTED UNDER THE AUTHORITY OF HIS MAJESTY'S STATIONERY OFFICE
BY HARRISON AND SONS, LTD., 44-47, ST. MARTIN'S LANE, W.C. 2.
PRINTERS IN ORDINARY TO HIS MAJESTY.

1920.

CONTENTS.

ORGANIZATION.

PART I.—TRAINING.

CHAPTER I.

PRINCIPLES AND SYSTEM OF TRAINING.

SEC.		PAGE
	PRINCIPLES OF TRAINING.	
1.	General instructions	7
2.	Responsibility for training	8
	SYSTEM OF TRAINING.	
3.	General instructions	8
4.	Recruit training	9
5.	Individual training	9
6.	Collective training	10

CHAPTER II.

CLOSE ORDER DRILL.

7.	General instructions	11
	CLOSE ORDER DRILL WITH LIMBERS.	
8.	A company in column forming line facing in the same direction	11
9.	A company in line advancing in column of sections ...	12
10.	A company in column forming column of route by sections	12
11.	A company in line moving to a flank in column of route by sections	12
12.	A company in column of route by sections forming forward into column of sections at the halt	13
13.	A company in column of route by sections forming column facing a flank at the halt	13
14.	A company in line moving to a flank in column of route	13
15.	A company in column of sections forming column of route	13

CHAPTER III.

INDIVIDUAL TRAINING.

16.	Aiming instruction	19
17.	Visual training...	22
18.	Rangefinding	22
19.	Ranging	25
20.	Signals	26
21.	Fire orders	27
22.	Allocation of duties	32

[7.20] (B 15379) Wt. P2794-SOP649 2M 4/21 H&S G S 197

CHAPTER IV.

MACHINE GUN DRILL.

SEC.		PAGE
23.	Elementary drill	34
24.	Tests of elementary training	52
25.	Combined drill—Direct fire	57
26.	Combined drill—Indirect fire	58
27.	Rough ground drill	64

CHAPTER V.

LIMBER DRILL.

28.	General instructions	68
29.	Packing limbers	69
30.	Action from limbers	70
31.	Load tables	71

CHAPTER VI.

PACK SADDLERY DRILL FROM LIMBERS.

32.	General instructions	78
33.	Loading pack saddles	78
34.	Action from pack saddles	80
35.	Load tables	80

CHAPTER VII.

TRAINING IN FIELD OPERATIONS.

36.	Elementary tactical exercises	85
37.	Advanced tactical exercises	89
3 .	Posting and relief of sentries...	92

CHAPTER VIII.

MACHINE GUN COURSE.

39.	General instructions	96
40.	Detail of parts I and II	104
41.	Examples of field practices	108
42.	Description of targets...	112

PAGE
... 34
... 52
... 57
... 58
... 64
... 68
... 69
... 70
... 71
RS.
... 78
... 78
... 80
... 80
... 85
... 89
... 92
... 96
... 104
... 108
... 112

LIST OF PLATES.

PART I.

PLATE		PAGE
I.	Key to Plates II, III, IV and V	14
II.	Machine gun company in line	15
III.	Machine gun company in column of sections	16
IV.	Machine gun company in column of route	17
V.	Machine gun company in column of route by sections	18
VI.	Attack range card...	23
VII.	Defence range card—No. 1 gun position	24
VIII.	Defence range card—No. 2 gun position	24
IX.	Elementary drill—"Fall in"	37
X.	Elementary drill—"Take post"	38
XI.	Elementary drill—erecting tripod	39
XII.	Elementary drill—mounting gun	40
XIII.	Elementary drill—normal firing position—sitting ...	41
XIV.	Elementary drill—lowest position—mounting gun ...	49
XV.	Elementary drill—lowest position—normal firing position	50
XVI.	Rough ground drill—gun firing along steep slope ...	66
XVII.	Rough ground drill—gun firing down steep slope ...	67
XVIII.	Fighting limber—fore portion—bottom layer	74
XIX.	Fighting limber—fore portion—top layer	75
XX.	Fighting limber—hind portion—bottom layer... ...	76
XXI.	Fighting limber—hind portion—top layer	77
XXII.	Pack saddle—gun and tripod pack—near side... ...	82
XXIII.	Pack saddle—gun and tripod pack—off side	83
XXIV.	Pack saddle—ammunition pack...	84
XXV.	Machine gun course targets	112

ORGANIZATION.

1. A Machine gun battalion consists of :—

Headquarters,
4 Companies.

The guns may be either Vickers or Maxim, but all the guns of the battalion will be of the same pattern.

2. A Machine gun company consists of :—

Headquarters,
4 sections, each of 4 guns.

A Machine Gun Company is commanded by a Major, with a Captain as second in command.

3. A section consists of two sub-sections, and is commanded by the senior of its two subaltern officers.

4. A sub-section consists of two gun teams, and is commanded by a subaltern. The sub-section is the smallest fire unit.

5. A gun team consists of the number of men detailed for the service of one gun. Each team is numbered from 1 to 8. The gun team is commanded by a gun commander, who will be a lance-corporal or selected gunner, other than the No. 1.

6. The machine guns of a section are carried in two limbered G.S. wagons, known as the fighting limbers. Each section has also one limbered G.S. wagon for ammunition.

7. Further details as to personnel, horses and vehicles are given in War Establishments.

PART I.—TRAINING.

CHAPTER I.

PRINCIPLES AND SYSTEM OF TRAINING.

PRINCIPLES OF TRAINING.

Section 1.—General instructions.

1. The object of training is to fit all ranks for the performance of their duties in war. This manual deals with the training of machine gun companies.

2. The principles on which all training must be based are contained in Field Service Regulations, Part I.

3. Drill is an essential factor of all training in order to establish and maintain a mutual understanding between a commander and his subordinates. It is of first importance in producing discipline and habits of absolute and instant obedience to the orders of a superior.

4. The training must include both moral and physical instruction. The development of a soldierly spirit is needed to help the soldier to bear cheerfully fatigue, privation and danger; to imbue him with a sense of honour; to give him confidence in his superiors and comrades; to increase his powers of initiative, self-confidence and self-restraint; to train him to obey orders, or to act suitably in their absence; to impress upon him that, so long as he is physically capable of fighting, surrender to the enemy is a disgraceful act; and, finally, to produce such a state of discipline that each individual will perform his duty coolly and correctly in the stress of battle.

5. Men selected for machine gun training should have strong physique, good eyesight, calm temperament, and a fair measure of education. Mechanical aptitude is also of value. The work of a machine gunner entails the frequent carrying of heavy weights, sometimes over long distances. Staying power and endurance are, therefore, of the utmost importance.

6. It is essential that all ranks should be highly trained and impressed from the beginning of their training with the need for accuracy and thoroughness. Enthusiasm and esprit de corps should be cultivated, and a keen competitive spirit fostered on all occasions.

7. All ranks should be encouraged to take part in games, as these are of value in teaching the importance of self-control, co-operation, self-confidence, initiative and determination.

removes the paper for a few seconds while the pupil notes where the line of sight strikes the target.

Section 2.—Responsibility for training

1. All commanders are responsible for the training and efficiency of their officers, warrant officers, non-commissioned officers, men and transport. They are also responsible that the guns, equipment and vehicles under their command are complete and fit for service. Officers, warrant officers, non-commissioned officers and men required for special duties must be maintained in accordance with the regulations.

2. Superiors, while holding their subordinates responsible for the training of their units, will never forego their functions of guidance and control, and will exercise a general and continuous supervision over their work. In carrying out this duty they must not curb the initiative of their subordinates nor interfere unnecessarily, so long as the training is conducted on sound lines. The development of initiative in all subordinate commanders is of vital importance, and anything likely to tend to its suppression must be avoided.

3. An officer should himself be capable of performing all the duties in which he is to train his men. When qualified, he should personally train his own command, making the most of the opportunities thus afforded to study the characters of his men, to find out the special qualifications of each, and to gain their confidence.

4. Every officer, warrant officer and N.C.O. should make himself acquainted with the duties of his immediate superior, so that he may be capable of fulfilling these duties should the occasion arise.

SYSTEM OF TRAINING.

Section 3.—General instructions.

1. The instructions laid down in Infantry Training, Sec. 3, will apply generally to the training of machine gun companies, substituting "sub-section" for "section" and "section" for "platoon" throughout.

2. Variety of work must be arranged, and every endeavour made to stimulate and maintain interest throughout the training, which will include many subjects requiring close application. Lessons should be short and frequent, and instruction should be carried out in the following sequence :—

A short lecture explaining generally the lessons to be learnt.
Demonstration by the instructor.
Detailed explanation by the instructor.
Imitation by the squad.
Interrogation of the squad by the instructor.

Section 4.—Recruit training.

Recruit training will consist of the subjects laid down in Infantry Training, Sec. 4, para. 1. The remaining paragraphs of Sec. 4 apply generally to the recruit training of the machine gunner.

Section 5.—Individual training.

The individual training will consist of :—

(i) The training of officers in professional duties as laid down in King's Regulations ; Training and Manœuvre Regulations ; Field Service Regulations, Parts I and II.

The machine gun officer must receive a thorough training in all the subjects laid down in The Tactical Employment of Machine Guns, The Handbook for the ·303 in. Vickers Machine Gun, and this manual. He should also possess a sound knowledge of the tactics of other arms.

(ii) The training of non-commissioned officers and privates likely to become non-commissioned officers in :—

The duties of a sub-section commander.
Elementary fire direction.
Fire control.
Reconnaissance.
Map reading.
Use of the compass.
The tactical employment of the gun.
The writing of messages and reports.
The subjects laid down in (iii) below.

(iii) The training of privates in :—

All the subjects laid down in Part I of this manual.
Mechanism, etc. (Handbook for the ·303 in. Vickers Machine Gun).
Defence against air-craft.
Physical training (Manual of Physical Training).
Marching and march discipline. (Field Service Regulations, Part I, Secs. 24 to 33 ; Infantry Training, Sec. 112).
The use of entrenching implements and entrenching tools.
Bombing.
Anti-gas training.

removes the paper for a few seconds while the pupil notes where the line of sight strikes the target.

Section 6.—Collective training.

1. The collective training of machine gun units in the field should not begin until proficiency has been attained in the subjects of individual training. From the beginning of his training the nature of his duties will impress upon the machine gunner the necessity for close co-operation with his comrades. Field operations, therefore, should be regarded both as a continuation of individual training and as practice in the co-operation of the machine gun unit with other units and other arms in the field. Every opportunity should be taken of training in co-operation with the infantry.

2. In addition to the subjects laid down in Chapter VII, field operations will include training in :—

Night operations. (Field Service Regulations, Part I, Chap. IX ; Infantry Training, Sec. 113).

Field engineering and the construction of machine gun emplacements (Manual of Field Engineering).

Duties in billets, camps and bivouacs. (Field Service Regulations, Part I, Chap. IV).

CHAPTER II.

CLOSE ORDER DRILL.

Section 7.—General instructions.

1. The sub-section will be exercised in all the movements of squad drill (Infantry Training, Chapter II), the word "sub-section" being substituted for "squad."

2. The section will be exercised in all the movements of platoon drill (Infantry Training, Chapter III), the word "section" being substituted for "platoon."

3. The company will be exercised in all the movements of company drill (Infantry Training, Chapter IV), the word "section" being substituted for "platoon."

4. Company drill with limbers :—

(*a*) As far as possible in all drill movements, the gun and ammunition limbers should accompany their respective sections, so that the latter may manœuvre as complete fighting units.

(*b*) In drill movements no transport will be on parade with the company, except the gun and ammunition limbers.

(*c*) No separate word of command will be given to the drivers of limbers. They will conform to the movements of the section to which they belong.

COMPANY DRILL WITH LIMBERS.

Section 8.—A company in column forming line facing in the same direction.

On the left (or right), form—Line. Remainder, left (or right)—Incline, quick—March.

The leading section will stand fast. Remainder will act as in squad drill.

When each section is immediately in rear of its position in line it will receive from its commander—*Right (or Left)*—*Incline*, and when on the alignment—*Halt*.

The company serjeant-major and limbers will move to their places in line during the movement. (Plate II.)

removes the paper for a few seconds while the pupil notes where the line of sight strikes the target.

Section 9.—A company in line advancing in column of sections.

Advance in column of sections from the right (or left). Remainder, right (or left)—Turn.

The right (or left) section commander will give: *Number—section, by the left (or right), quick—March.*

When the limbers are clear, No. 2 section commander will give—*Number 2 section, quick—March.* When the head of the section is in rear of the centre of the preceding section the commander will give—*Left (or right)—Incline.* On arriving in column of sections, again—*Left (or right)—Incline.*

The remaining sections will act in similar manner.

During the movement the limbers of each section will take up their position in column. (Plate III.)

Section 10.—A company in column forming column of route by sections.

Advance in column of route by sections from the right. Form—Fours—Right.

The commander of the leading section will give: *Number—section, left wheel—Quick—March.*

When the limbers of the leading section are clear, the section commander of the next section will give: *Number—section, left wheel—Quick—March.*

The remaining sections will act in similar manner. (Plate V (A)).

Section 11.—A company in line moving to a flank in column of route by sections.

Move to the right (or left) in column of route by sections, number—section leading. Form—Fours—Right (or left).

The section commander of the named section will give—*Quick—March.*

When the limbers of the section are clear the next section commander will give—*Quick—March.*

The remaining sections will act in similar manner. (Plate V (A)).

NOTE.—In the event of action being expected, the formation in Sections 10 and 11 will be as shown in Plate V (B).

Section 12.—A company in column of route by sections forming forward into column of sections at the halt.

At the halt, on the left (or right), form column of—Sections.

The commander of the leading section will at once give—*At the halt, on the left (or right) form—Section.*

The commanders of the remaining sections on arriving at column distance will act in a similar manner.

During this movement the limbers will move to their positions in column of sections.

Section 13.—A company in column of route by sections forming column facing a flank at the halt.

At the halt, facing left (or right), form column of—Sections.

The commander of the leading section will halt his section and turn it to the left (or right).

The limbers will take up their position in column of sections. The remaining sections will be led by their guides by the shortest route to their positions in column, when they will receive the command—*Halt—Left (or right)—Turn.*

Section 14.—A company in line moving to a flank in column of route.

Move to the right (or left) in column of route, number—section leading. Form—Fours—Right (or Left). Quick—March.

When the rear of the last section is clear the transport will march in the following order: Gun, ammunition, H.Q. limbers, water cart, travelling kitchen, train transport (if allotted).

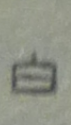
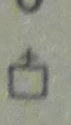
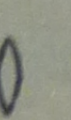
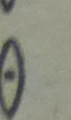
The transport will be supervised by the transport officer and transport serjeant. (Plate IV).

Section 15.—A company in column of sections forming column of route.

Advance in Fours from the right. Form—Fours. Right. Sections, left wheel. Quick—March.

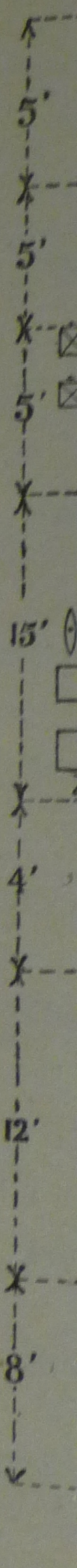
Each section will move in the required direction, forming column of fours. When the rear of the last section is clear the transport will march as indicated in Section 14. (Plate IV).

removes the paper for a few seconds while the pupil notes where the line of sight strikes the target.

	COY. COM^{DR} (Mounted)
	2ND IN COMMAND (do.)
	SECTION OFFICER (do.)
	TRANSPORT OFFICER (do.)
	SUB-SECTION OFFICER
	COY S.M
	COY Q.M.S
	TRANSPORT SG^{T} (Mounted)
	SERGEANT
	CORPORAL
A	ARTIFICER
B	BATMAN
C	COOK
R	RUNNER or SCOUT
E	SADDLER
M	STOREMAN
S	SHOEING SMITH
	HORSE OR MULE
	DRIVER (Mounted)
Z	BRAKESMAN

NOTE.—In Plates II, III, IV and V, when the formations there shown are employed for drill purposes, the Gun and Ammunition Limbers will be the only transport on parade.

PLATE I.—KEY TO PLATES II, III, IV AND V.



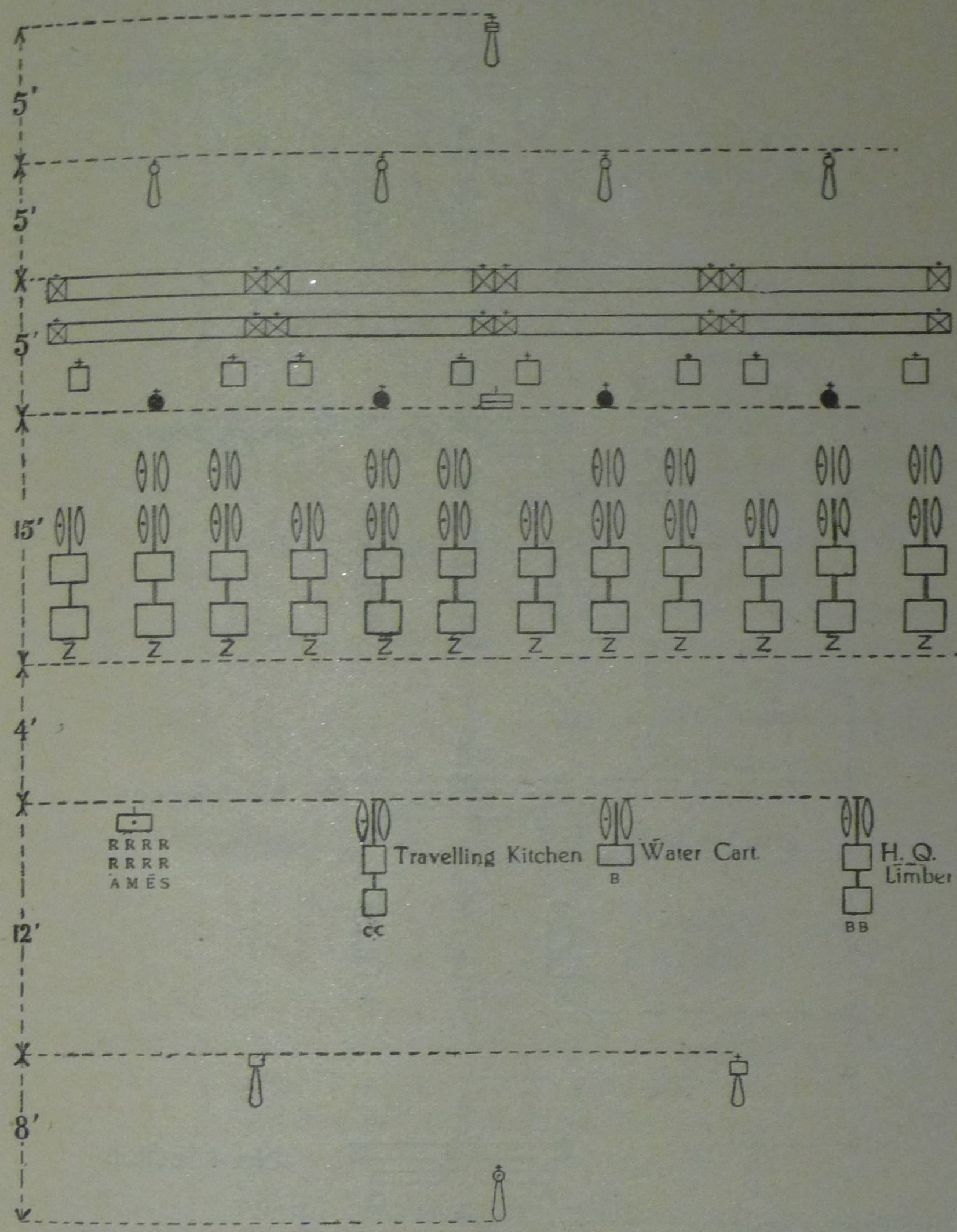
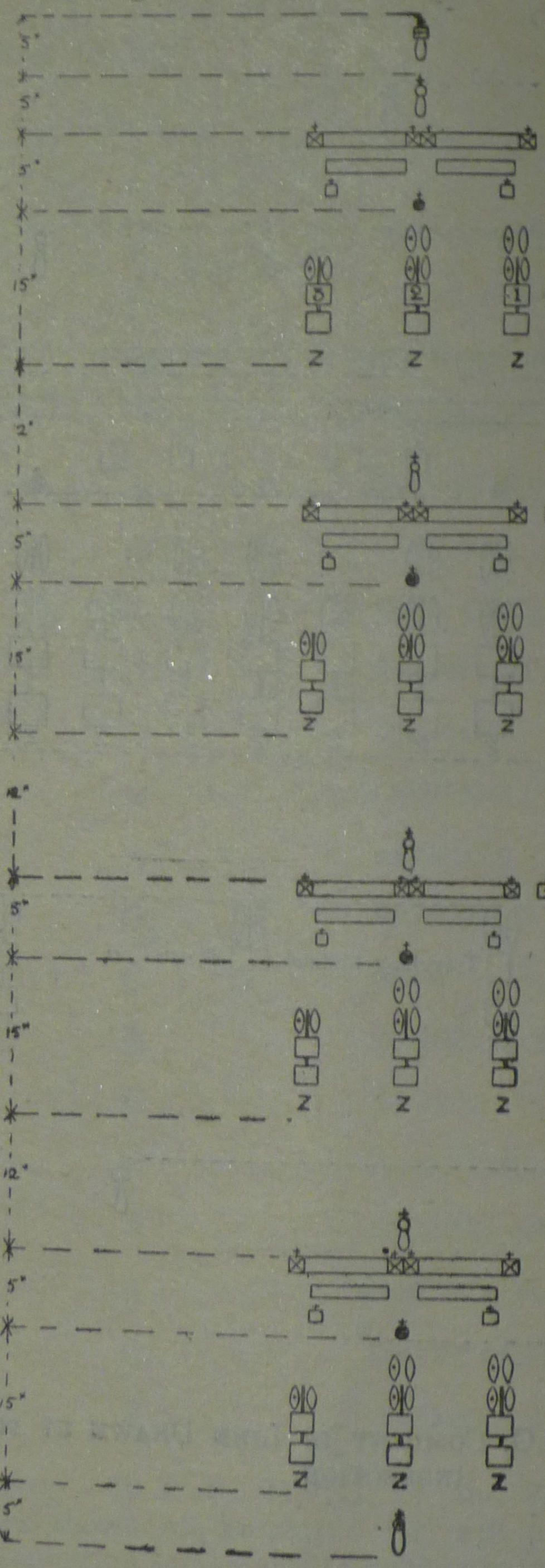


PLATE II.—M.G. COMPANY IN LINE DRAWN UP FOR INSPECTION.

removes the paper for a few seconds while the pupil notes where the line of sight strikes the target.



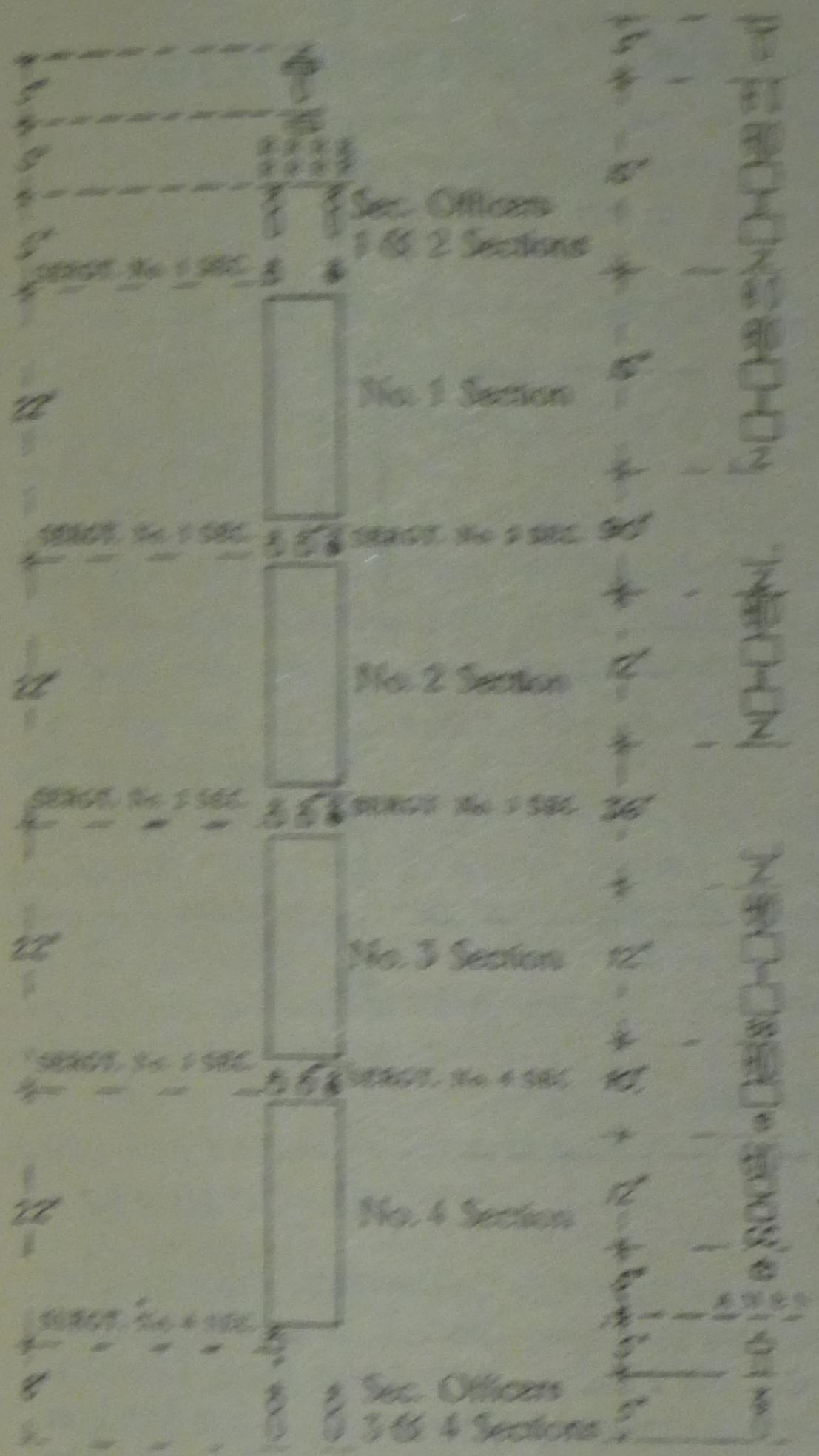
No. 1 Section.

No. 2 Section

No. 3 Section

No. 4 Section

PLATE III.—M.G. COMPANY IN COLUMN OF SECTIONS.

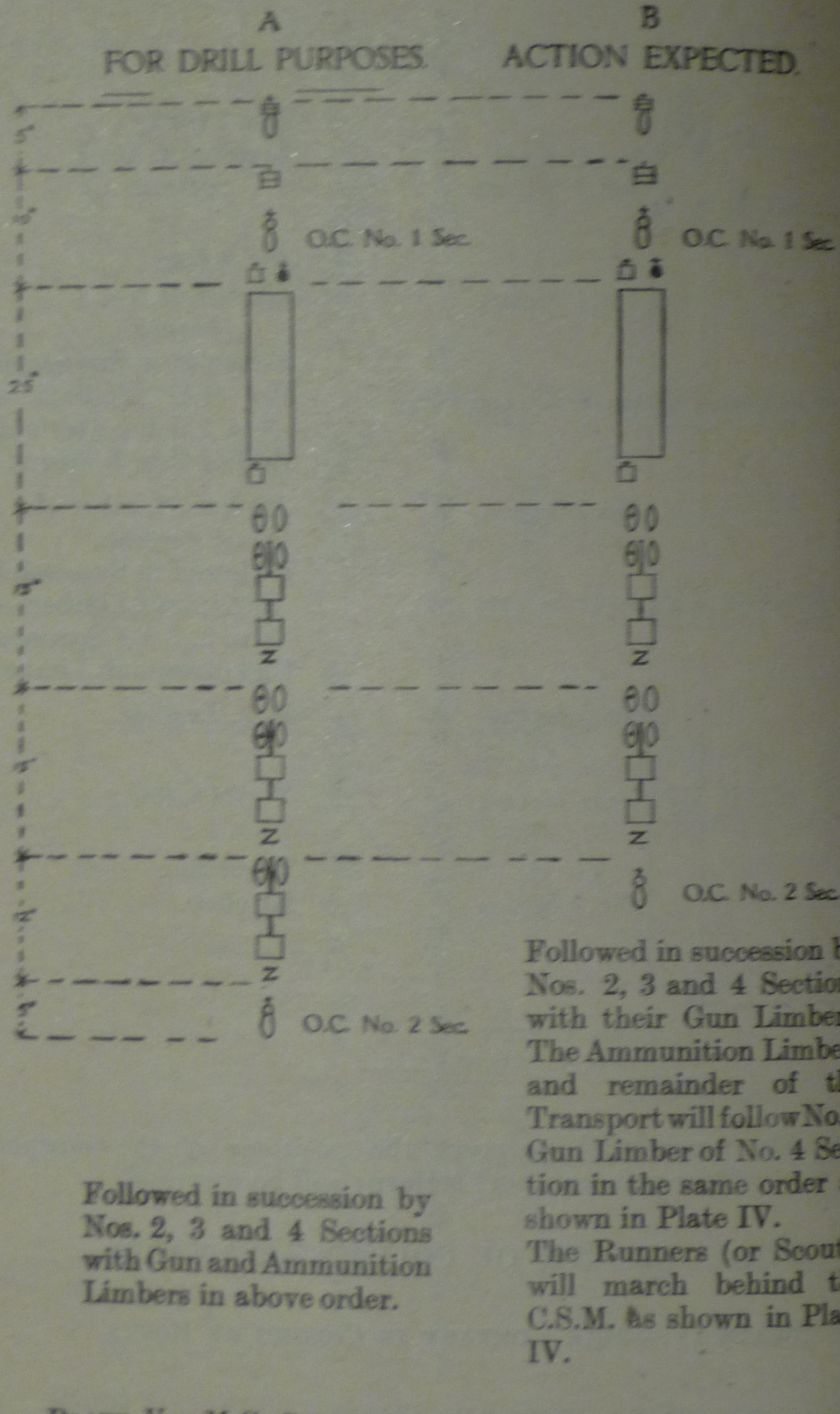


NOTE.—For ceremonial purposes the positions of the transport officer and transport serjeant will be reversed.

TOTAL LENGTH OF COLUMN = 333 YARDS.

PLATE IV.—M.G. COMPANY IN COLUMN OF ROUTE.

removes the paper for a few seconds while the pupil notes where the line of sight strikes the target.



Followed in succession by Nos. 2, 3 and 4 Sections with Gun and Ammunition Limbers in above order.

Followed in succession by Nos. 2, 3 and 4 Sections with their Gun Limbers. The Ammunition Limbers and remainder of the Transport will follow No. 2 Gun Limber of No. 4 Section in the same order as shown in Plate IV.
The Runners (or Scouts) will march behind the C.S.M. as shown in Plate IV.

PLATE V.—M.G. COMPANY IN COLUMN OF ROUTE BY SECTIONS.

CHAPTER III.

INDIVIDUAL TRAINING.

Section 16.—Aiming instruction.

The soldier must be instructed on the lines laid down in this chapter before he commences "sight setting and laying" in elementary drill.

1. Kit required: Gun, tripod, belt box, aiming disc, miniature bull's eye target, figure and landscape targets.

2. The instructor should first impress upon the squad the importance of correct aiming, from the machine gun point of view.

3. The use of the sights—to obtain direction and elevation—will be explained.

4. The method of adjusting the sights will be demonstrated and explained. Fifty yards will be taught as the smallest adjustment. The instructor should impress upon the men that the correct line on the graduated plate for any particular range is the one *under* the figures indicating that range. The men should be required to make several adjustments.

5. The following rules for aiming will then be given, and diagrams used to make the explanation clear:—

(*a*) Sights upright.
(*b*) Master eye used.
(*c*) Blade in centre of "U," and tip in line with shoulders.
(*d*) Aim directed at the centre of the lowest visible part of the aiming mark.
(*e*) Eye about 6 inches from rear crosspiece.

6. The miniature bull's eye target will then be placed about 10 yards away. The instructor will lay a correct aim without holding. He will explain that direction is obtained by tapping the traversing handles, and that the elevating wheel must be turned in order to elevate or depress the gun. Whilst laying, the chin must be supported on the hand. A belt box may be placed across the knees and the elbows rested on the box, or the box may be placed on the ground, resting on end, and the arms rested on the top.

7. Every man should then view the aim, after which the men themselves, in turn, will lay the gun. They will not "hold" the gun during this lesson. The reasons for taking a regulation aim should be explained.

removes the paper for a few seconds while the pupil moves
where the line of sight strikes the target.

Should any faults be detected, the instructor will point out what effects they would have on shooting, and will see that such faults are remedied.

8. When sufficient progress has been made, the men must be tested by the "Triangle of error" test. The method of carrying out this test, and the qualifying standard will be the same as described and laid down in Musketry Regulations (section 39), except that a gun and a Mark IV. tripod will be used instead of a rifle and aiming rest.

9. After passing the test (Musketry Regulations, para. 299, sub-para. v), the correct method of "holding" the gun will be shown and explained. The following points in connection with "holding" should be impressed upon the men:—

(*a*) The correct method of holding the traversing handles is with the third and little fingers round the handles, second fingers behind the safety catch, forefingers on top, and thumbs resting lightly on the thumbpiece; except when the gun is laid, when the safety catch should be raised with the second fingers.

(*b*) Whenever the traversing handles are held, the same grip and pressure must be maintained: *i.e.*, they must not be held loosely at one time and firmly at another.

(*c*) Any vertical play, due to wear in mountings, must be prevented by pressure on the handles, equal pressure being exerted with both hands.

(*d*) The pressure must not be so great that the vibration of the gun, when firing, will be transmitted to the tripod.

(*e*) On no account should play be prevented by pressing the handles up.

(*f*) The elbows should, whenever possible, be supported by the inside of the thighs.

(*g*) Whenever the gun is being laid, and one hand is being used for tapping or moving the elevating wheel, the gun must be held correctly with the other hand: *i.e.*, the "holding" must be such that there will be no movement of the gun when the second hand grips the traversing handle.

10. The instructor will then give a demonstration of laying with "holding" after which the men, in turn, will practise. They will be told to guard against disturbing the gun when moving the head to one side n order to enable the instructor to check the aim.

NOTE.—When checking an aim the instructor should steady himself by resting one finger lightly on the top of the traversing handle, being careful not to disturb the aim whilst doing so.

11. When the men can aim and hold the gun correctly, using a bull's eye target, similar practice will be given on figure targets, then on landscape targets, and finally on natural features in the open country.

A perfect aim must be insisted upon at all times.

CORRECT AIM WITH APERTURE SIGHT.

12. The method of aiming with the aperture pattern of "fixed sight" will be taught when the ordinary sight has been mastered. The system of instruction will be as described below :—

(*a*) Illustration of a correct aim by diagram.

(*b*) Used up to 500 yards, for all targets, except point targets, *e.g.*, loop-hole.

(*c*) Rules for aiming.

(i) Sights to be upright.

(ii) The master eye to be used.

(iii) The tip of the foresight in the centre of the aperture and the aim directed at the centre of the lowest visible part of the aiming mark.

(*d*) Method of instruction.

(i) Half-inch bull's eye target at 10 yards.

(ii) Rest for pupil's head (as in para. 6).

(iii) Instructor lays a correct aim.

(iv) Pupil views that aim.

(v) Pupil lays aim ; instructor criticises.

Men should be instructed to look through the aperture and not at it ; also to note the field of view, which should be shown in the diagram.

NOTE.—Faults in aiming can be readily pointed out as follows : The instructor holds a piece of white paper in front of the foresight, obliterating the aiming mark, and instructs the pupil to look along the sights, taking care that the foresight is kept in correct relation to the backsight ; he then removes the paper for a few seconds while the pupil notes where the line of sight strikes the target.

Should any faults be detected, the instructor will point out what

Section 17.—Visual Training.

Visual training should be carried out as laid down in "Notes for Instructors on the use of the Rifle" (40/W.O./6969). Frequent practice in the examination of ground should be given during the later stages of individual training. This should at first be confined to the recognition of natural and artificial features and the general character of the country; next, the importance of these features should be pointed out with reference broadly to the attack and the defence of the area in which they lie; and finally, attention should be called to those which are of particular interest to the machine gunner, *e.g.*, positions for observation to the front and to the flanks, positions that offer a good field of fire, areas on which observation of fire is likely to be obtained, localities from which hostile attacks may develop, the visibility of sky-lines, &c. By such practice a necessary introduction will be obtained to the more detailed study of cover, reconnaissance and the selection of gun positions (Sec. 36).

Section 18.—Rangefinding.

Rangefinding is the process determining the distance in yards to a given target.

1. Methods of rangefinding.

(i) Instrument.—At least one man in each gun team will be specially trained in the use and adjustment of the rangefinding nstrument. At least one officer and N.C.O. in the section should also be so trained, and every opportunity should be taken of practising all ranks in its uses.

The error in rangefinding by this method should not exceed 5 per cent. of the range.

(ii) Maps.—This method is valuable when maps of large scale and known accuracy are available, and, if these are read correctly, the error should be negligible.

The error that may arise owing to the inaccuracy of a map should not exceed 5 per cent. of the range.

(iii) Judging distance.—The machine gunner will be trained in judging distance as laid down in "Notes for Instructors on the use of the Rifle" (40/W.O./6969). Owing to the fact that the gun is fitted with a fixed sight for ranges up to 500 yards attention should be particularly directed to the recognition of the 500 yards range. All ranks will be trained in judging distances up to 1,400 yards.

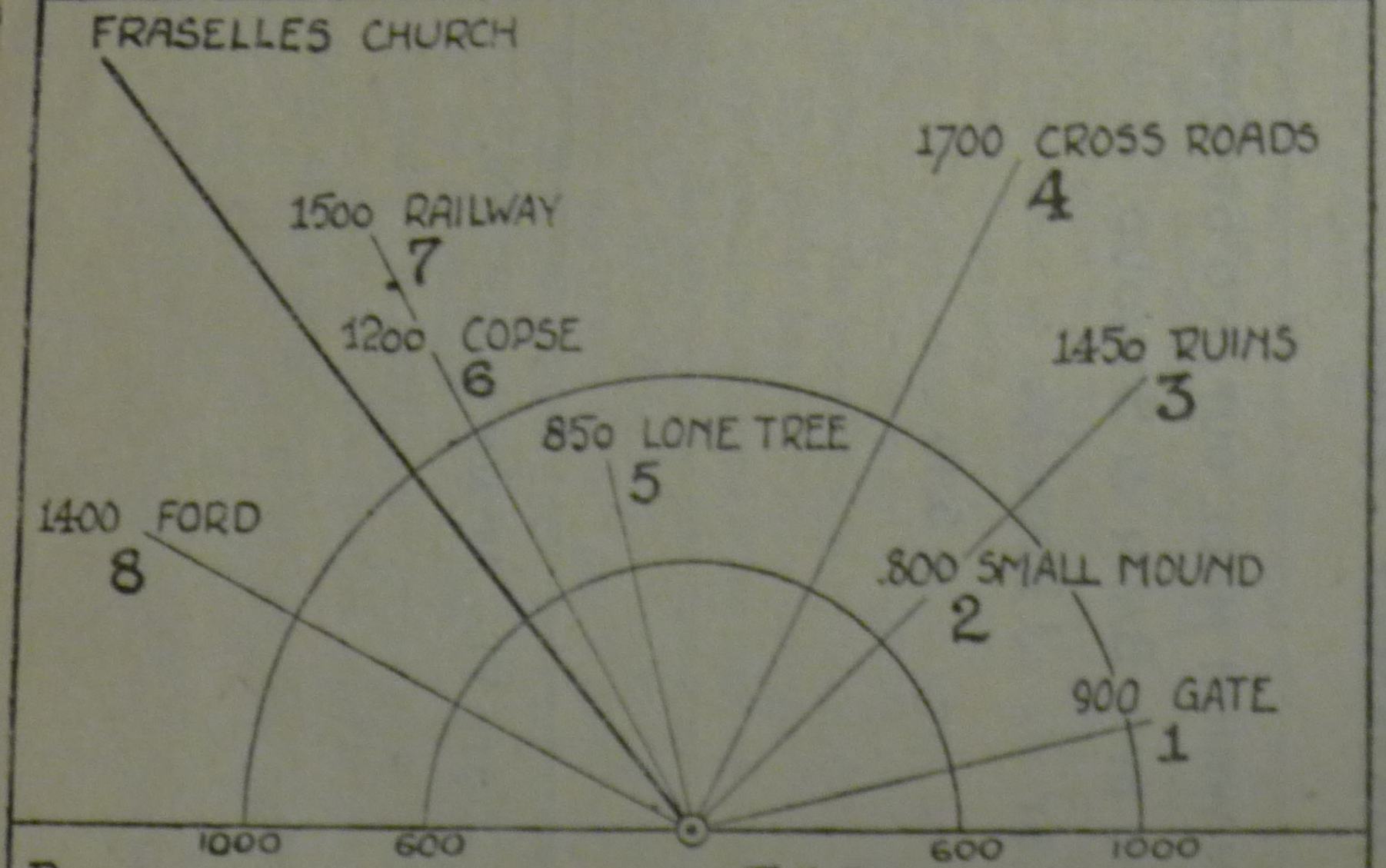
The error by this method should not exceed 15 per cent. of the range.

0	FINAL OBJECTIVE.	2000
400	RUINED MILL.	1600
900	RED COTTAGE.	1100
1150	LONE TREE.	850
1600	ROAD JUNCTION	400
2000	ASSEMBLY POINT.	0

POINT FROM WHICH MADE OUT :- 100° S OF SUGAR FACTORY
RANGE FOUND BY :- BARR & STROUD.
MADE OUT BY :- J. WOOD L/C
DATE :- 4 5 18.

PLATE VI.—ATTACK RANGE CARD.

RANGE CARD : Nº 1. GUN

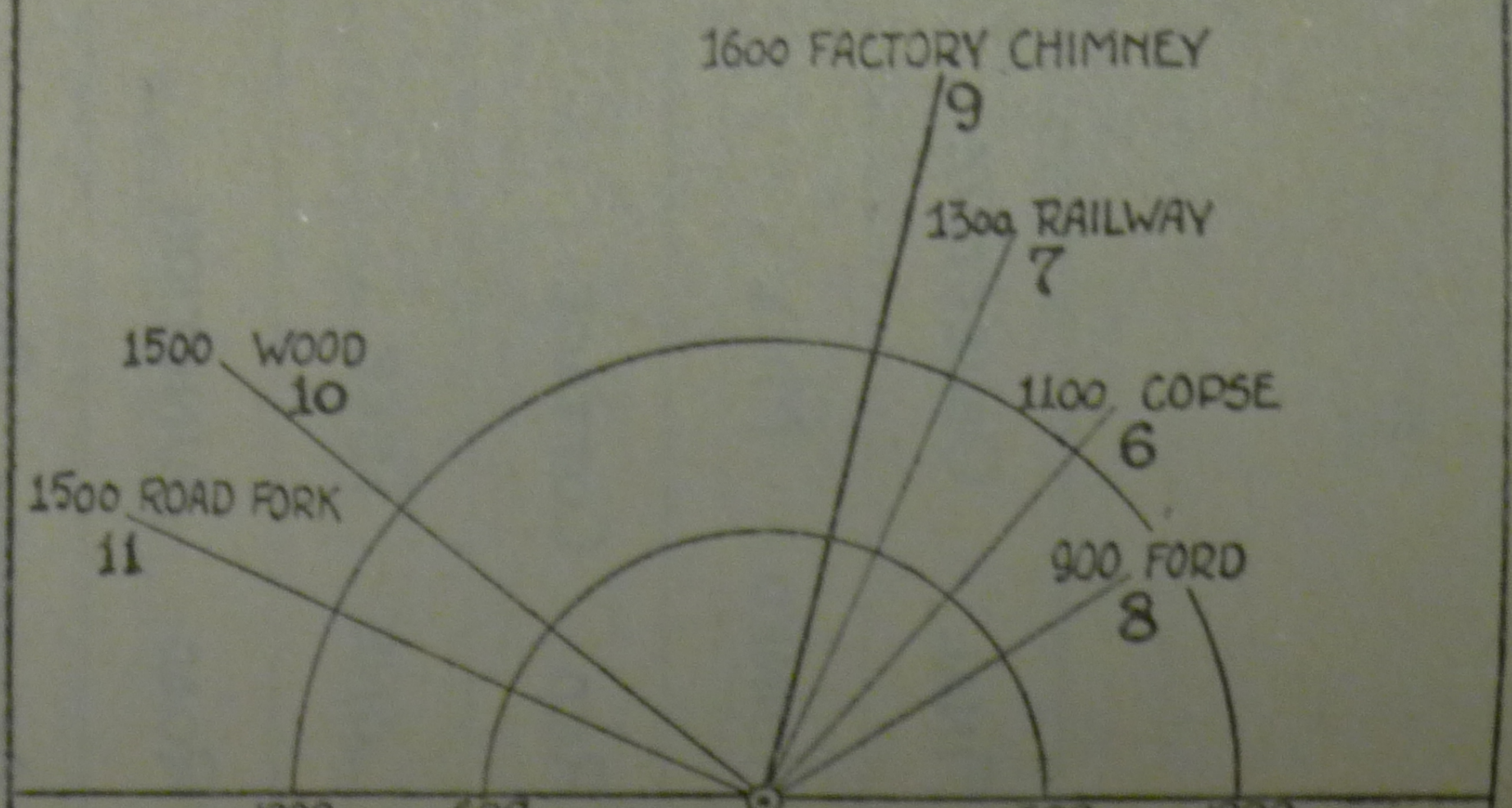


POINT FROM WHICH MADE OUT: 50ˣ E. OF OLD BRICKSTACK.

MADE OUT BY: DATE:

NOTES:

RANGE CARD : Nº 2. GUN



POINT FROM WHICH MADE OUT: 100ˣ S. OF CROIX MARESCHAL

MADE OUT BY: DATE:

NOTES:

PLATE VII. DEFENCE RANGE CARDS. PLATE VIII.

F. Russell

Ra
of fir
Th
from
ing
Bre
the si
(
(
(

(iii) The rate of movement should be such that the line of sight is moved about one yard in two seconds, when the target

(iv) Range cards.—In this method, objects are marked to which the range (key range) can be accurately obtained by either of the first two methods, and intermediate distances are estimated. (Plates VI, VII and VIII).

For these intermediate distances the error should not exceed 10 per cent. of the range.

2. Points to be observed in making a range card for the defence.

(i) The position from which the range card is taken must be clearly defined.
(ii) Draw two semi-circles with radii representing 600 yards and 1,000 yards.
(iii) Draw a thick setting ray to a prominent object which should be as far away as possible.
(iv) Rule lines of proportionate length, and at correct angles.
(v) Describe each object as it appears to the naked eye.
(vi) Write all words in block letters horizontally.
(vii) Place the range on the left of each object.
(viii) The section officer should number the objects from right to left, and co-ordinate the object numbers of adjacent guns from right to left. (Plates VII and VIII).
(ix) Mark in any trench, river, &c., that may run across the front.
(x) Sign and date each card, and give the method of range-finding used.
(xi) Ensure that each gun number recognizes each object.

Breadth of target.—This can be obtained by various methods, the simplest being the following :—

(i) From the map.
(ii) By using the gun and direction dial, if the range to the target is known. One degree subtends a distance equal to one-sixtieth of the range to the target.

Section 19.—Ranging.

Ranging (or registering) is the process of determining by observation of fire the direction and elevation required to hit a given target.

The direction and elevation necessary to hit the target may differ from those required under normal conditions for any of the following reasons :—

(i) Atmospheric influences.
(ii) Peculiarities of the individual gun. These may be inherent, or may be caused by wear, especially of the barrel.
(iii) Variation in the ammunition.
(iv) "Holding" of the No. 1.

Should any faults be detected, the instructor will point out what

Ranging should be employed whenever the tactical situation permits. If it is used, surprise effect will probably be lost; consequently, when circumstances allow, ranging should be carried out some time before a target is expected to be engaged.

Good observation of fire can only be obtained on a suitable surface *e.g.*, a dry ploughed field, or water. If the immediate vicinity of the target is unsuitable, fire should be directed on to any suitable position near the target, provided that the difference in range to the target can be easily determined. Telescopes, field glasses, or the rangefinding instrument should be used to observe fire, and positions from which observation can be obtained must be carefully selected. Care must be taken to avoid mistaking the fringe of the beaten zone for the nucleus, and to avoid the errors which are liable to be made when observing from above the gun or from a flank (Musketry Regulations, paras. 334 and 335).

Instruction should be given in the methods of ranging before the Machine Gun Course is fired. Bursts of fire of 15 to 20 rounds are usually sufficient; and, when fire is unobserved, alterations of elevation must be made boldly.

Section 20.—Signals.

The machine gunner will receive instruction during his recruit training in the signals laid down in Infantry Training, Secs. 94 and 95.

The following machine gun signals will be used for controlling movements and fire:—

"Action."—Both arms, fully extended, raised from the sides to a position in line with the shoulders and lowered again. This motion to be repeated until it is seen that the signal is being complied with.

"Out of action."—Arm swung in a circular motion in front of the body.

"Gun ready to fire."—The No. 2 will extend his left arm horizontally.

"Stand by, ready to fire."—The controlling officer will raise his hand.

"Fire."—The controlling officer will drop his hand. The No. 2 will tap the No. 1 lightly on the back and order "Fire."

"Cease Fire."—The controlling officer will wave his forearm horizontally, elbow close to the side. The No. 2 will tap the No. 1 lightly on the back, and order "Cease fire."

The following semaphore code will be used :—

O.	Fire observed over.
S.	Fire observed short.
R.	Fire observed to right of target.
L.	Fire observed to left of target.
K.	Fire observed correct.
W.	Fire unobserved, or "Wash-out."
S.A....	More ammunition required.
W.T.	More water required.
L.U.	Limber to come up to gun position.

Section 21.—Fire orders.

Before fire orders can be practised, a high standard of training must have been reached in the subjects contained in the previous sections of this chapter. In addition, officers and N.C.Os. must possess a sound knowledge of fire direction. A correct fire order is the final expression of all the factors which have to be considered before fire is opened. Constant practice both in the delivery and execution of fire orders is of the utmost importance.

In the early stages of training in this subject attention will be paid to accuracy, rather than to speed. The training will be progressive, beginning with the simplest of orders and leading gradually to the more advanced orders, some examples of which are given below. The first lessons may be given on the landscape target, but every opportunity must be taken of giving practice in the open country. On all occasions *service targets* must be indicated.

Delivery of fire orders.

(i) *Sequence.*—A uniform sequence must be practised in the delivery of fire orders as follows :—

(*a*) The detail of guns required for the particular order—*e.g.*, "By sub-sections," "No. 1 gun only," etc.

(*b*) The range (*i.e.*, the sighting elevation required to hit the target). This should be given first in order that, after adjusting his sights, the firer may focus his eyes to the approximate distance thus assisting his recognition of the target ; and so that there may be no need for the firer to remove his eyes from the target after it is recognized.

(*c*) The indication of the target. This should be as short and explicit as possible. A target must be described as it appears to the naked eye.

(*d*) The type of fire—*e.g.*, "Searching," etc.

(*e*) The command or signal "Fire"—after No. 2's hand is raised to show that the gun is laid.

Should any faults be detected, the instructor will point out what

(ii) *Methods.*

(*a*) Word of mouth. The fire order must be given as an order. The order should be given :—

Loudly.
Calmly.
Concisely.
With pauses between each part of the order, so that No. 1 may have sufficient time to act.

(*b*) By telephone or runner, when the position of the commander so demands.

(*c*) By the officer himself laying one gun and ordering the Nos. 1 to look along the sights of that gun and lay their own guns similarly with the given range. This method is useful when accuracy of indication is particularly difficult.

(iii) *Position of the commander.*

The position of the commander should enable him to :—

(*a*) Observe fire.
(*b*) Observe the movements of the enemy.
(*c*) Observe the position of our own troops.
(*d*) Communicate with the Nos. 2.

For control of fire, the officer should be on the left of the guns, in order that his signals may be seen by the Nos. 2 ; but if he is out of their sight signals may be given by whistle, connecting file (this should not be the serjeant) or telephone.

Execution of fire orders.

Practice in the execution of fire orders is designed to inculcate implicit obedience and prompt action on the part of the No. 1 (Infantry Training, Sec. 117). It will also serve to quicken his intelligence and power of observation. The repetition of orders by No. 1, and the transmission to him of signals by No. 2, must always be insisted upon and any laxity immediately checked.

Practice will be given in the execution of anticipatory orders, in which the range and target are given before the occasion for firing arises, and fire is opened without further orders at the pre-arranged moment.

Careful training will be required in the execution of orders involving the use of traversing, searching and combined sights.

Examples of Fire Orders.

RANGING. *Example*:—"Number 1 gun only—1,000—Pond—Ranging—Fire."

Duties of the No. 1 (*a*) With an observer. He will fire a burst and await orders. The observing officer will order, *e.g.*, "Up (or down) 100—One tap right (or left)," as a result of the observation he has obtained. No. 1 will make the necessary alterations in direction and sighting elevation. This is continued until the correct direction and sighting elevation to hit the target have been obtained.

(*b*) Without an observer.—He will fire a burst and make the necessary alterations in direction and elevation, *without altering his sighting elevation*, until fire is observed to be correct. He will then adjust his tangent sight slide until his line of sight is on the target, and he will report the direction and sighting elevation to the controlling officer.

TRAVERSING. (*a*) Inwards traversing.—This is the normal method with two or more guns.

Example:—"1,000—Between tree and gate—Inwards traversing."

The duties of the Nos. 1 on receipt of the order depend on the number of guns being used. Having adjusted their sights, the Nos. 1 would select the following points of aim with reference to the limits of traverse:—

No of Guns.	Points of aim in enemy line for each gun.			
	No. 4.	No. 3.	No. 2.	No. 1.
4	Left	Left centre	Right centre	Right
3	...	Left	Right or left centre	Right
2	...	...	Left	Right

When the signal to fire is given, guns will traverse their own respective limits, overlapping slightly. When three guns are used, the centre gun will traverse the centre third of the target, the flank guns traversing inwards to ,overlap the limits of traverse of the centre gun.

(*b*) Outwards Traversing may be employed if the tactical situation demands it.

(*c*) Oblique Traversing. The principles and orders are the same. It will be convenient in many cases to use a combination of combined sights and traversing.

Should any faults be detected, the instructor will point out what

Example :—" 1,000 : 100 yards differences—Between tree and gate—Inwards traversing."

If the angle of obliquity is large, the Nos. 1, after traversing a short distance, must alter their sighting elevations and relay. The officer will control this alteration of sighting elevations, but in the absence of orders the gunner should himself make the necessary alterations.

(*d*) The Swinging Traverse is used against dense targets at very close range, say, up to 500 yards.

SEARCHING. (*a*) To overcome errors in rangefinding.

Example :—" 1,000—Cross roads—to 1,300—Searching."

Duties of No. 1 on receipt of the order. He adjusts the tangent sight slide to 1,000 yards and aims at the target indicated. He then alters his sight to 1,300, without altering the elevation of the gun.

Duties of No. 1 on the signal "Fire." He fires a burst, elevates, fires another burst, and continues in this sequence until aiming at the target indicated with 1,300 on his sights.

NOTE.—In the above case, as soon as the controlling officer observes the fire to be correct he will cease fire, ascertain the correct sighting elevation, *discontinue searching*, and order fire to be re-opened with the correct elevation.

(*b*) To engage a target in depth.

(i) When the near and far end of the target, and the gun are all on the same plane.

Example :—" 1,000—Near end of hedge—to 1,300—Searching."

Duties of No. 1 on receipt of the order, and of the signal "Fire." In this case, as only the near end of the target will be visible to the firer, the procedure will be the same as in (*a*). When he has fired at the target with 1,300 on his sights, if it is necessary to search down, on receipt of the order he will, in the above example, adjust the tangent sight slide to 1,000, fire a burst, depress, fire another burst, and continue in this sequence until the line of sight is again on the target.

(ii) When the target is on a forward slope.

Example :—" 1,000—Near end of hedge—to 1,300—Far end —Searching."

Duties of No. 1 on receipt of the order are the same as in (*a*).

Duties of No. 1 on the signal "Fire." He fires and elevates until aiming at the *far end* of the target. When he has fired at the far end with 1,300 on his sights, if it is necessary to search down, on receipt of the order he will, in the above example, adjust the tangent sight slide to 1,000 and fire and depress until the line of sight is on the *near end* of the target.

(iii) The rate of movement should be such that the line of sight is moved about one yard in two seconds when the target

NOTES.—(i) In (*a*) and (*b*) above, if two guns are used the orders will be the same, but the left gun will search up and the right gun will search down.

(ii) For the length of the burst of fire in the execution of traversing and searching fire orders, *see* Sec. 23, paras. 16, 17 and 18.

COMBINED SIGHTS. (*a*) To overcome errors in rangefinding.

Example :—"1,000 : 50 yards differences—Cross roads." Duties of No. 1 on receipt of the order. The order should be given from a flank, and the No. 1 nearest the controlling officer will repeat the order, adjust his tangent sight slide to 1,000, and lay on the target. The next No. 1 will call out "1,050 : 50 yards differences—Cross roads," and adjust his sights to 1,050, and lay on the target. This action will be repeated down the guns by the Nos. 1 in turn.

NOTES.—(i) When fire has been opened, using combined sights, with all guns laid on the same point of aim, the Nos. 1 are not allowed to alter elevation from observation of the strike of their supposed bullets, owing to the difficulty of determining the zones of the respective guns.

(ii) The controlling officer, if he succeeds in determining the correct sighting elevation, will cease fire, *discontinue combined sights*, and order fire to be re-opened with the correct elevation.

(iii) Combined sights may be ordered by the controlling officer against such a target as will allow different lateral points of aim being given to each No. 1. In this case, the No. 1 may alter his elevation directly he sees that his fire is not striking the target, without waiting for orders from the controlling officer, and any No. 1 who ascertains the correct sighting elevation from observation of fire must at once report it to the controlling officer.

(*b*) To engage a target in depth.

The example and procedure are the same as in (*a*), but if the controlling officer observes the fire of one or more guns to be outside the area which he wishes to engage, he will cease fire, order a new sighting elevation, and re-open fire, *still using combined sights*.

NOTE.—In (*a*) and (*b*) above, combined sights may also be ordered by sub-sections, in which case the order will be, "By sub-sections—1,000 : 50 yards differences—Cross roads." On receipt of the order the commander of the sub-section nearest the controlling officer will repeat the order, and will then order "Left (or Right) sub-section—1,000—Cross roads." The commander of the next sub-section will call out "By sub-sections—1,050 : 50 yards differences—Cross roads," and will then order "Right (or Left) sub-section—1,050—Cross roads."

Should any faults be detected, the instructor will point out what

Section 22.—Allocation of duties.

1. The duties of the section commander are to command the section in accordance with his orders and the tactical situation, to select gun positions, to observe and to control fire generally, to regulate the ammunition supply, and to give instructions regarding the movements of his limbered wagons.

2. The duties of the sub-section officer are to assist the section commander and to act as second-in-command of the section. He should be qualified to replace the section commander should the latter become a casualty. Normally he will command one sub-section in action.

3. The duty of the serjeant is to supervise the guns coming into action as his sub-section officer may direct. He is responsible for replacing casualties among the gun numbers. The senior sub-section serjeant must be prepared to take command of the section in the event of both the officers becoming casualties.

4. The duty of the corporal in charge of the limbers is to supervise packing and unpacking. He will have the spare parts box handy, supervise the ammunition supply, direct the gun limber as required, and he must keep in touch with the section officer. He will be prepared to take the place of the serjeant should the latter become a casualty.

5. The following are the duties of the various numbers :—

No. 1 is the firer. He will personally clean and look after his gun, and ensure that the mechanism is working smoothly. On going into action he will carry the Mark IV tripod and place it in position, and assist No. 2 in mounting the gun. He repeats all orders received, observes his own fire when possible, makes the necessary alterations of direction and elevation, and observes the movements of his own troops and of the enemy.

No. 2 carries the gun into action and assists No. 1 to mount it. On going into action he will secure the condenser tube to the gun, and will carry the spare parts case. He will attend to the feeding of the gun, watch for signals from the officer, and generally assist No. 1.

No. 3 is responsible for keeping the gun supplied with ammunition, seeing that the condenser (half-filled with water) reaches the gun position before the water in the barrel casing boils, and for carrying out minor repairs whilst the gun is in action.

No. 4 assists No. 3 in his duties. He is responsible for keeping No. 3 supplied with ammunition, water, oil and spare parts as required.

(iii) The rate of movement should be such that the line of sight is moved about one yard in two seconds, when the target

The remaining numbers will act according to the orders of the section or sub-section officer.

6. The duties of a N.C.O. acting as "gun commander" are to supervise generally the firing of the gun. In carrying out indirect fire, he will see that the correct direction and elevation are placed and maintained on the gun. He must watch for signals from the controlling officer.

7. Section officers will ensure that each man of the section is thoroughly trained in the duties of each "number." A system of "changing round" will be arranged, so that every man will perform the several duties of the section in turn.

8. At least one man in each gun team will be trained in the use and adjustment of the Barr and Stroud rangefinder.

Should any faults be detected, the instructor will point out what

CHAPTER IV.

MACHINE GUN DRILL.

Section 23.—Elementary drill.

1. Elementary drill will consist of the following:—

(i) Mounting the gun.
(ii) Dismounting the gun.
(iii) Loading.
(iv) Unloading.
(v) Sight setting and laying.
(vi) Coming into action.
(vii) Coming out of action.
(viii) Traversing and searching.
(ix) Mounting and dismounting the gun in the lowest position.

In order that training may be progressive this sequence should be adhered to.

1.—Kit required for each gun team.

Gun fitted with auxiliary mounting, Mark IV tripod, belt box with belt and dummies, spare parts case complete, and landscape target and targets for Part I of the machine gun course.

2.—Laying out of kit.

(i) The gun and tripod will be placed in line on the ground, about 3 paces apart, and about 30 yards from the landscape target.
(ii) Tripod on the left, legs to the rear.
(iii) Gun on the right, muzzle pointing to the front.
(iv) Spare parts case alongside and on the right of the gun.
(v) The belt box about 3 paces in rear of the interval between gun and tripod.
(vi) When two gun teams are drilling together the interval between the kits of the teams should be about 8 paces.

3.—"Fall in."

On the command "Fall in" each team will fall in, in single rank, and stand at ease about 5 paces in front of the kit. (Plate IX.)

4.—"Number."

On the command "Number," the team will number as in squad drill. The team will be cautioned that the *No. 1 will repeat all subsequent orders*, and that No. 2 will convey all signalled orders to No. 1.

(iii) The rate of movement should be such that the line of sight is moved about one yard in two seconds, when the target

5.—"Take post."

On the command "Take post," the gun team will turn to the right and move at the double to positions as follows—No. 1 will pass behind the gun and tripod and fall in on the left of the tripod. No. 2 will fall in on the right of the gun. No. 3 will fall in on the left of the ammunition box. The remaining numbers will fall in about 5 paces in rear of No. 3, No. 4 being on the right. When the state of the ground permits, all numbers will lie down. (Plate X.)

As soon as the No. 1 arrives at his position he will see that the elevating and cross-head joint pins are properly in position and turned down, and that both elevating screws are equally exposed, clamps tight, strap round rear leg and buckled, traversed clamp sufficiently tight to prevent the crosshead from swinging round when the tripod is being carried, direction and elevation dials secure.

No. 2 will at once attend to the following points—cork plug in, auxiliary mounting properly fixed, sliding shutter closed, front cover locked, "T" fixing pin screwed home and vertical, tangent sight set at 600, muzzle attachment correctly adjusted, and will sling the spare parts case across his right shoulder, first making certain that the contents are complete. (The inspection of the spare parts case is carried out twice only during drill—by the first No. 2 and by the last No. 2). Care must be taken that the strap passes underneath the box respirator, if the latter is worn in the alert position.

No. 3 will examine the belt, see that the dummies are correctly placed in position and pointing the right way, and will then close the box. The catch of the ammunition box will be towards the front. He will then report "Ammunition correct" to No. 2, who will then report "Gun and ammunition correct" to No. 1, who in turn will report "All correct" (or otherwise) to the instructor.

6.—"Mount gun."

NOTE.—The instructor will now bring the team to the left of the position where the gun is to be mounted, so that they may see all movements clearly and listen to explanations. He will then act as No. 1 himself, giving and repeating the order "Mount gun," and will point out a position, which will be about 25 yards from the target, where the gun is to be mounted.

(a) To erect the tripod.

On the command "Mount gun," No. 1 picks up the tripod, doubles forward to the position indicated, and places it in position. Whilst adjusting it the following points must be attended to: The cross-head bracket should be held by the left hand, close to the socket,

Should any faults be detected, the instructor will point out what

the left forearm being supported by the left thigh, and both the jamming handles should, if possible, be manipulated with the right hand. (Plate XI.)

When the tripod is mounted the socket must be upright, the clamps tight, the tripod a convenient height for the firer when in a sitting position, and the rear leg in line with the target. No. 1 will sit down behind it, and remove the elevating and cross-head joint pins whilst doing so.

(b) To dismount the tripod.

No. 1 springs up and doubles back to the original position with the tripod. He will then replace both pins, taking care that they are properly in and turned down, loosen the jamming handles, fold the legs and clamp them together again. He will then stand to "Attention" on the left of the tripod (or lie down).

NOTE.—Before dealing with the action of No. 2, all the members of the team should be practised in erecting and dismounting the tripod. When they have made reasonable progress with the tripod, the instructor will then continue the instruction in "Mount gun." He will order one of the team to erect the tripod, and will then himself act as No. 2.

(c) To mount the gun.

No. 2 picks up the gun, taking care not to dig the muzzle attachment into the ground whilst doing so, and opens the sliding shutter. Then, holding the right traversing handle with the left hand and carrying the barrel casing under the right arm, he doubles forward to the tripod, arriving about the same time that No. 1 is removing the elevating and cross-head joint pins. He then kneels on his left knee, places the gun on the tripod, supporting the barrel casing with the right thigh, and, releasing hold of the traversing handle, which should be taken by No. 1, with his right hand he drives in the cross-head joint pin, the handle being straight up whilst doing so, and then turns it down (Plate XII). He then removes the cork plug. Meanwhile No. 1 similarly puts in the elevating joint pin and turns it down.

No. 2 then lies down on the right of the gun, places the belt box in position in line with the feed block, and sees that the strap on the box is clear of the lid, or, if a metal box is used, that the quick release strap is disengaged.

After putting in the elevating joint pin, No. 1 will at once level the gun, test the traversing clamp to see that it is "sticky," and then sit with elbows resting inside the thighs, and hold the traversing handles correctly. Eyes must be directed towards the target, and not at his hands or gun.

NOTE.—The instructor will then act as No. 3.

(iii) The rate of movement should be such that the line of sight is moved about one yard in two seconds, when the target

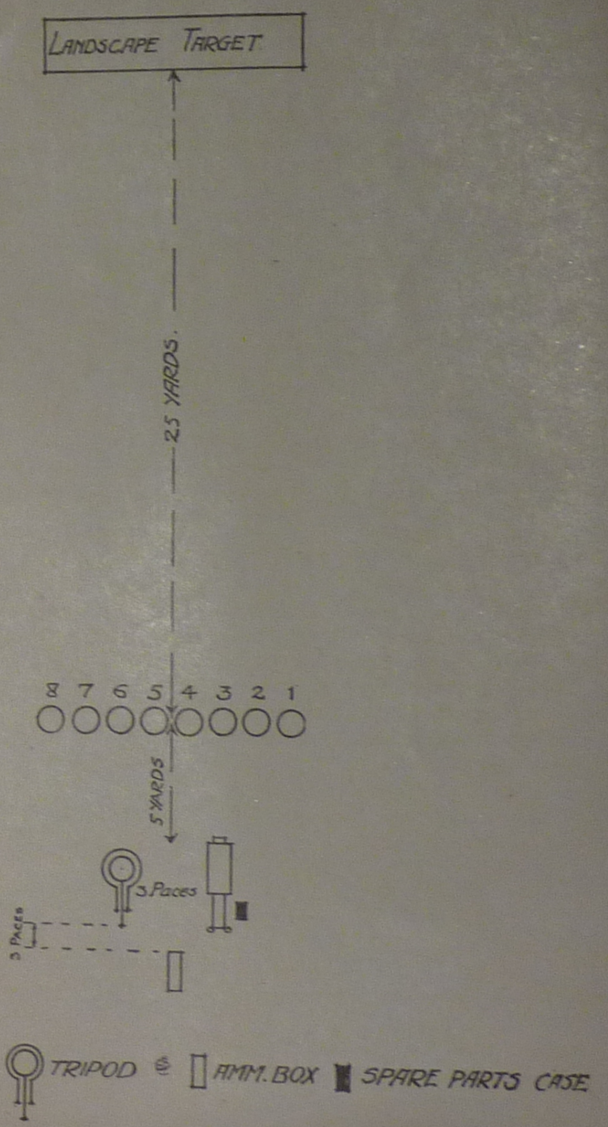


PLATE IX.—ELEMENTARY DRILL—"FALL IN."

Should any faults be detected, the instructor will point out what

38

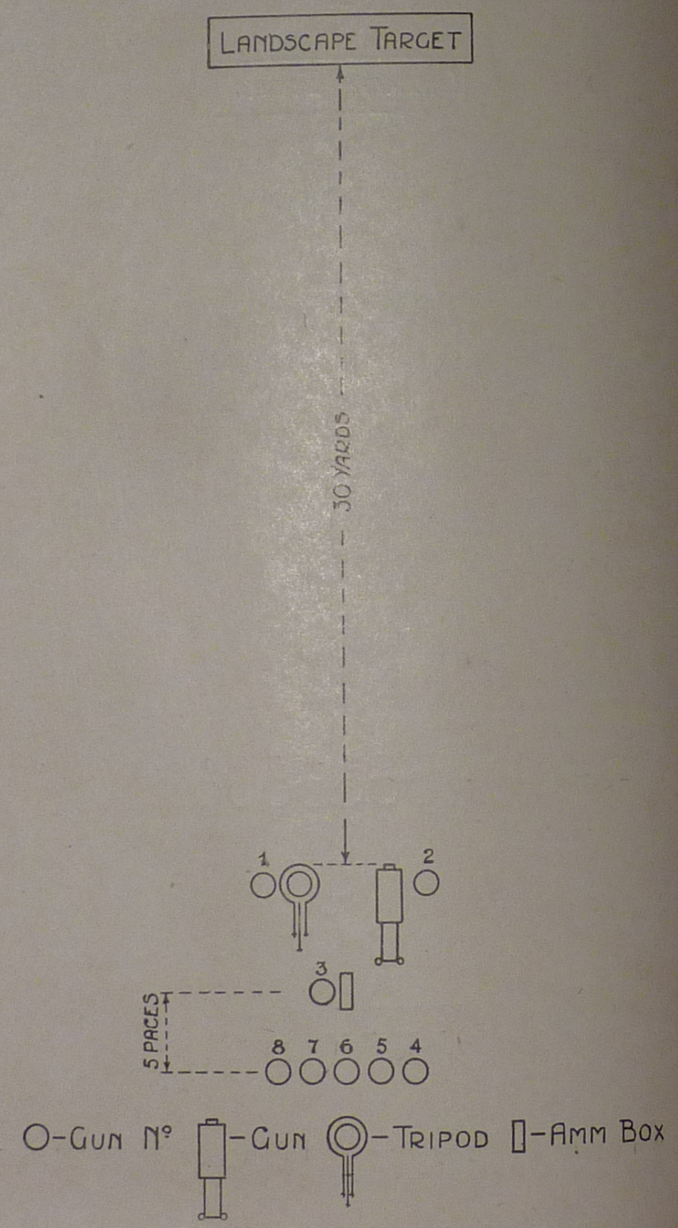


PLATE X.—ELEMENTARY DRILL—"TAKE POST."

(iii) The rate of movement should be such that the line of sight is moved about one yard in two seconds, when the target

39

PLATE XI.—ELEMENTARY DRILL—ERECTING TRIPOD.

Should any faults be detected, the instructor will point out what

PLATE XII.—ELEMENTARY DRILL—MOUNTING GUN.

(iii) The rate of movement should be such that the line of sight is moved about one yard in two seconds, when the target

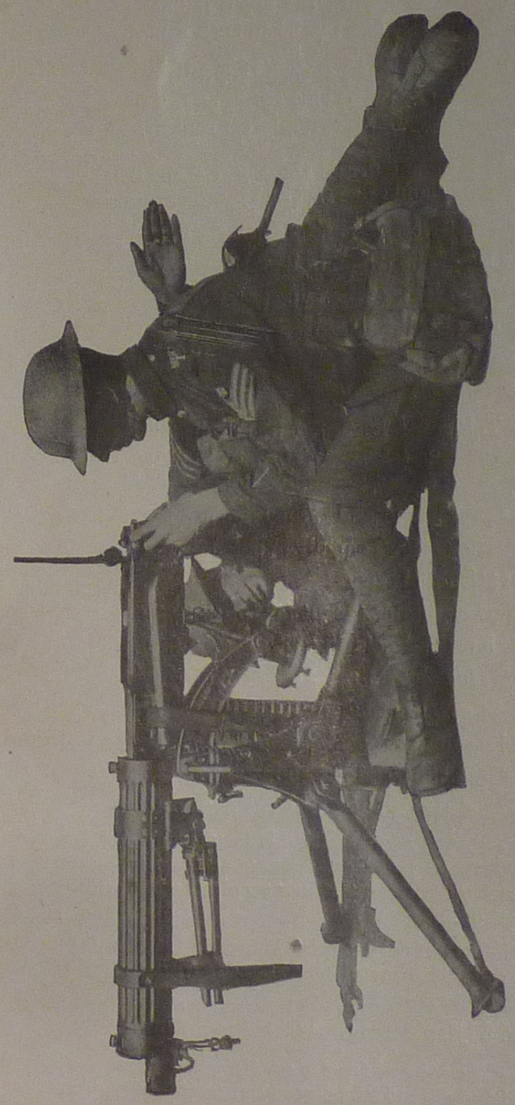


PLATE XIII.—ELEMENTARY DRILL—NORMAL FIRING POSITION.—SITTING.

Should any faults be detected, the instructor will point out what

No. 3 will double forward with the ammunition box and place it conveniently for No. 2—*i.e.*, the catch (or quick release strap) towards the gun and the box placed in such a position that No. 2 is not likely to knock it over as he lies down. The ammunition box must be at hand directly No. 2 is ready for it.

No. 3 then doubles away, taking care not to take up a position directly behind the gun. If cover is convenient, he should take advantage of it.

When the gun is mounted, and the Nos. 1, 2 and 3 are in position, the following points should be criticised by the instructor:—

(i) Actions of Nos. 1, 2 and 3 until the gun is mounted.

(ii) Rear leg of the tripod in line with the target.

(iii) Shoes, not legs, of the tripod on the ground.

(iv) Jamming handles tight.

(v) Socket upright.

(vi) Traversing clamp sticky.

NOTE.—This must be tested by the instructor in the same way that the No. 1 tests it—*i.e.*, by tapping the traversing handle.

(vii) Pins properly in and turned down.

(viii) Elevating screws equally exposed.

(ix) Elevation dial secure.

(x) Tripod a suitable height for the firer.

(xi) Gun level and pointing towards the target.

(xii) Cork plug out.

(xiii) Front cover locked.

(xiv) Sliding shutter open.

(xv) Tangent sight slide at 600 yards.

(xvi) No. 1 sitting and holding the gun correctly.

(xvii) No. 2 lying down, with his head below the level of the gun, spare parts case slung across his shoulder, with strap underneath the box respirator if worn in the alert position.

(xviii) Belt box in correct position, with the strap clear of the lid; or, if a metal box is used, with the quick release strap disengaged.

(xix) No. 3 lying down in rear and to a flank.

NOTE.—When the instructor criticises, the faults each number has committed should be pointed out to the whole team.

(iii) The rate of movement should be such that the line of sight is moved about one yard in two seconds, when the target

87.—"**Dismount gun.**"

NOTE.—Here again the instructor will demonstrate the duties of each number in turn.

On the command "Dismount gun," No. 1 will remove both pins, and as soon as No. 2 has removed the gun, he will spring up and double back with the tripod to the original position. He will then replace both pins, loosen the jamming handles, fold up the legs, and tighten the jamming handles, and if necessary align the cross head arm over the rear leg.

No. 2 will push the belt box away from the tripod, lift the gun from the tripod, replace the cork plug, and then double back to his original position. Before placing the gun on the ground he will close the sliding shutter. He will finally re-set the sight at 600 yards if necessary.

No. 3 will double forward, seize the belt box, and carry it back to the original position. Should the box be fitted with a quick release strap, he will see that it is fastened, when back at the original position.

88.—"**Load.**"

NOTE.—The instructor will act as the No. 1 and then as the No. 2, the team standing near the gun.

On the command "Load," No. 1 pulls the crank handle on to the roller with the right hand, and advances his left hand to the left of the feed block, ready to grip the belt.

No. 2 opens the belt box, holds the end of the belt (at the point where the brass tag joins the fabric) with his forefinger (right hand recommended) along the tag, and pushes the tag through the feed block as far as possible.

NOTE.—With the metal belt boxes, both halves of the lid will be opened. One half may be closed later if necessary.

No. 1 grips the tag, and pulls the belt through the feed block as far as possible. He must pull the belt *slightly* to his left front when doing so. He then releases the crank handle, taking care not to allow his right hand to move forward with it. He again pulls the crank handle on to the roller, pulls the belt slightly to his left front and releases the crank handle. Whilst pulling the crank handle on to the roller the belt will be held (but not pulled) with the left hand. He then resumes his holding on the gun.

NOTE.—The instructor should explain that the pulling of the belt slightly to the left front is only to avoid the natural tendency to pull it to the rear, *i.e.*, towards the No. 1, and that to pull the belt too much to the left front, or with much force, must be guarded against.

Should any faults be detected, the instructor will point out what

9.—"Unload."

NOTE.—The instructor will perform the duties of No. 1 and then of No. 2, the team standing near the gun.

On the command "Unload," No. 1 will pull the crank handle on to the roller, and immediately allow it to fly forward again. Should the tangent sight be up, it will be lowered at the same time with the left hand. He will repeat this movement. He will then press the top and bottom pawls of the feed block with the right hand, the top pawls being pressed with the thumb, and the bottom pawls with the fingers, taking care to keep the hand clear of the entrance to the feed block. No. 2 will withdraw the belt and pack it carefully in the box. When the last round is clear of the feed block No. 1 will press the thumbpiece with the left hand. The wooden box must be locked, but with the metal box the lids need only be closed, not locked.

NOTE.—All numbers should now be practised in loading and unloading until reasonable progress is made. Should any man exhibit a tendency to slur the loading motions, it may be advisable to make him load "by numbers," counting aloud whilst doing so.

10.—To adjust the sights.

NOTE.—Before this lesson and the next are dealt with, instruction in aiming must have been given. (Sec. 16, "Aiming instruction.")

On the range being given, No. 1 will raise the tangent sight (unless the range is 500 yards or under, when the fixed sight will be used), and adjust the slide to the range ordered.

11.—To lay the gun.

On the target being indicated by the instructor, No. 1 will tap the gun over until the correct direction is obtained, and elevate or depress until the aim is correct. Should a large change in direction be necessary, No. 1 will order No. 2 to loosen the traversing clamp, and will swing the gun roughly on to the target, order No. 2 to tighten, and then lay accurately by taps. It is most important that whilst tapping the gun, or manipulating the elevating wheel, the correct "holding" should be maintained with the other hand.

As soon as the aim is correct and the correct holding taken, No. 1 will, by the word "Up," order No. 2 to put up his hand (Plate XIII).

NOTE.—After the instructor has given a demonstration of how to lay the gun all the men will be exercised.

Care must be exercised when checking the aim, to prevent the gun from being moved as the No. 1 moves his head to one side to allow the aim to be viewed by the instructor.

(iii) The rate of movement should be such that the line of sight is moved about one yard in two seconds, when the target

12.—"Fire."

On the command or signal "Fire" being given, No. 2 will tap No. 1 lightly on the back and say "Fire," and No. 1 will instantly press the thumbpiece. He must press it in as far as possible, and must not disturb the aim whilst doing so.

The thumbpiece must be pressed in by a quick and even movement of the thumbs, and the eyes must be directed at the target. The tendency to look down at the thumbpiece must be checked.

13.—"Cease fire."

On the command or signal "Cease fire" being given No. 2 will tap No. 1 lightly on the back and say "Cease fire," and No. 1 will at once release the safety catch, and release the pressure on the thumbpiece. He should then check his aim, and correct it if necessary.

14.—"Action."

When the men have made sufficient progress in the foregoing lessons, they will be exercised in combining them, and coming into "Action." Three aiming marks, which must be service targets, will be indicated on the landscape target by the instructor. (The instructor may walk up to the target to do this.) After the range and target have been given, the command or signal "Action" will be given. The gun will then be mounted, loaded and laid; and when the No. 2 puts up his hand, the various points taught in the earlier lessons will be criticised. The laying of the gun should be the first point criticised.

NOTE.—No. 2 must not be allowed to adjust the sights. Each number must perform the duties laid down in the earlier lessons.

15.—"Out of Action."

The following methods of taking the gun out of action will now be explained and practised.

The particular method to be employed would depend upon the circumstances at the moment, No. 1, as a rule, deciding which method to employ.

First method.

When the gun is in action and no cover exists in the vicinity.

In this case, the gun will be unloaded and dismounted on the spot, each No. then carrying away his own load,

On service No. 3 might not be required Nos. 1 and 2 dealing with the belt box or boxes, as circumstances suggest.

For instructional purposes, in this case, the instructor will give the caution "No cover" before the command "Out of action."

The gun will be unloaded & dismounted on the spot.

On service No. 3 might not be required. Nos 1 & 2 dealing with the belt box or boxes as circumstances require

Should any faults be detected, the instructor will point out what

Second method.

When the gun is in action and cover is presumed to exist in the vicinity, *e.g.*, gun in action firing just over the top of a bank, or over the shoulder of a mound.

In this case the gun will be unloaded, except that the belt will be left in the feed block, and the gun will then be dragged back under cover (Nos. 1 and 2 taking care not to expose themselves), after which the unloading and dismounting will be completed. For instructional purposes the instructor will give the caution "Short cover" before the command "Out of action."

Third method.

When the gun is in action and cover exists which is too far away to permit of the gun being dragged the whole way, but close enough to avoid the necessity of dismounting it on the spot (say, up to 50-60 yards).

Two courses are open to the gun numbers.

(*a*) *Two man load.*

The gun will be unloaded by Nos. 1 and 2 without removing the belt; No. 1 will hold the rear and left legs, No. 2 will hold the right leg of the tripod and carry the ammunition box as most convenient, the belt still being through the feed block.

(*b*) *Three man load.*

The gun will be unloaded without removing the belt, and No. 3 signalled up.

No. 1 will hold the left leg of the tripod with the left hand. No. 2 will hold the right leg with the right hand, and the ammunition box with the left hand, the belt still being through the feed block. No. 3 will hold the rear leg with the right hand.

NOTES.—(i) The procedure laid down for two and three man loads will be taught, but the class should be warned that there are variations in each which may be preferred by individuals, the end to be aimed at in all cases being speed.

For instructional purposes the instructor would give the caution "Long cover, two (or three) man load," before the command "Out of action," and would point out where the cover is supposed to exist.

If there are more than one belt box at the gun, the No. 3 will come up to the gun, so necessitating the "Three man load," for which the cautionary words would have to be given.

(ii) A convenient way of carrying the tripod for any distance is to arrange it on the shoulders so that the rear leg lies flat down the back, while the front legs are clamped at an angle of about 45° with the horizontal, and rest on the shoulders.

(iii) The rate of movement should be such that the line of sight is moved about one yard in two seconds, when the target is 25 yards from the gun. The movement of the gun is

16.—Traversing.

The gun will be mounted exactly 25 yards from the target, as used in the Machine Gun Course, Practice 1, before instruction begins; and the fact that the figures are four inches apart, and that each space measures two inches across, must be pointed out to the men.

The instructor will explain that the object of the exercise is to develop a consistent, automatic tap, and to teach the degree of tightness required in the traversing clamp, in order that the line of sight may be displaced two inches at 25 yards each time the gun is tapped.

The following points will then be explained:—

(i) A strong tap with a tight clamp is much preferable to a weak tap with a loose clamp.

(ii) When tapping with either hand, the gun must be held correctly with the other hand, and the safety catch kept raised.

(iii) Eyes must be directed at the target the whole time, and not at the rear end of the gun or along the sights, except momentarily for checking the aim.

(iv) If the gun moves too much or too little, the *traversing clamp* must be altered, *not* the tap.

Between each tap, the thumbpiece will be pressed about two seconds, which is the time required to fire a group of 5 to 10 rounds.

The instructor will then show how he tests the traversing clamp, and give a demonstration of traversing. All numbers will then be exercised, traversing with the left as well as with the right hand; the tangent sight will be raised, but not used, during the exercise.

17.—Searching.

The gun will be mounted exactly 25 yards from the target, as used in the Machine Gun Course, Practice 1, the target will be placed on end.

The instructor will explain that the object of the exercise is to train men to turn the wheel so that the line of sight is displaced up, or down, two inches at 25 yards for every turn.

The following points will then be explained:—

(i) The wheel will be manipulated with the right hand only.

(ii) The wheel must be grasped firmly and turned boldly—not hesitatingly.

(iii) Eyes must be directed at the target whilst the wheel is turned.

NOTE.—Whilst learning, the men should be allowed to look along the sights, so that they may realise how much the wheel ought to be moved.

Should any faults be detected, the instructor will point out what

Between each turn of the wheel, the thumbpiece will be pressed for about four seconds, which is the time required to fire a group of 30 to 40 rounds.

The instructor will give a demonstration, the men afterwards being exercised.

18.—Oblique traversing.

The gun will be mounted exactly 25 yards from the target, as used in the Machine Gun Course, Practice 1. Small figures should be passed diagonally across the upper part of the target, four inches apart.

The instructor will explain that the object of the exercise is to train men in combining traversing with the manipulation of the elevating wheel. An example of when such a combination might be necessary—say a hedge running obliquely away from the gun position—will be given.

The following points will then be explained :—

(i) The correct sequence of action must be followed, *i.e.*, Fire, tap, elevate (or depress).

(ii) The tapping must be automatic as in ordinary traversing.

(iii) When elevating or depressing the gun, the sights must be used.

It is apparent that the greater the angle which the line to be traversed makes with the horizontal, the greater will be the turn necessary to bring the sights on to the mark after traversing, and *vice versa*. The turn in this case must not be confused with the two-inch turn in the previous lesson.

The thumbpiece will be pressed from one to four seconds, the greater the angle between the line to be traversed and the horizontal, the longer the pressure.

The instructor will give a demonstration, after which all the men will be exercised.

19.—Swinging traverse.

The gun will be mounted exactly 25 yards from the target, as used in the Machine Gun Course, Practice 1.

The instructor will explain that this method of traversing is only employed against linear targets at very close ranges, when the normal method of traversing is likely to prove too slow.

The following points will then be explained :—

(i) A certain amount of "stickiness" is advisable from the point of view of control, the vibration of the gun rendering it easy to swing.

(ii) The gun must not be moved by a movement of the forearms only. The upper part of the body should be fairly rigid, and the gun should be moved by forcing the upper part of the body over to the opposite side to which it is desired to traverse.

(iii) The rate of movement should be such that the line of sight is moved about one yard in two seconds, when the target is 25 yards from the gun. The movement of the gun is

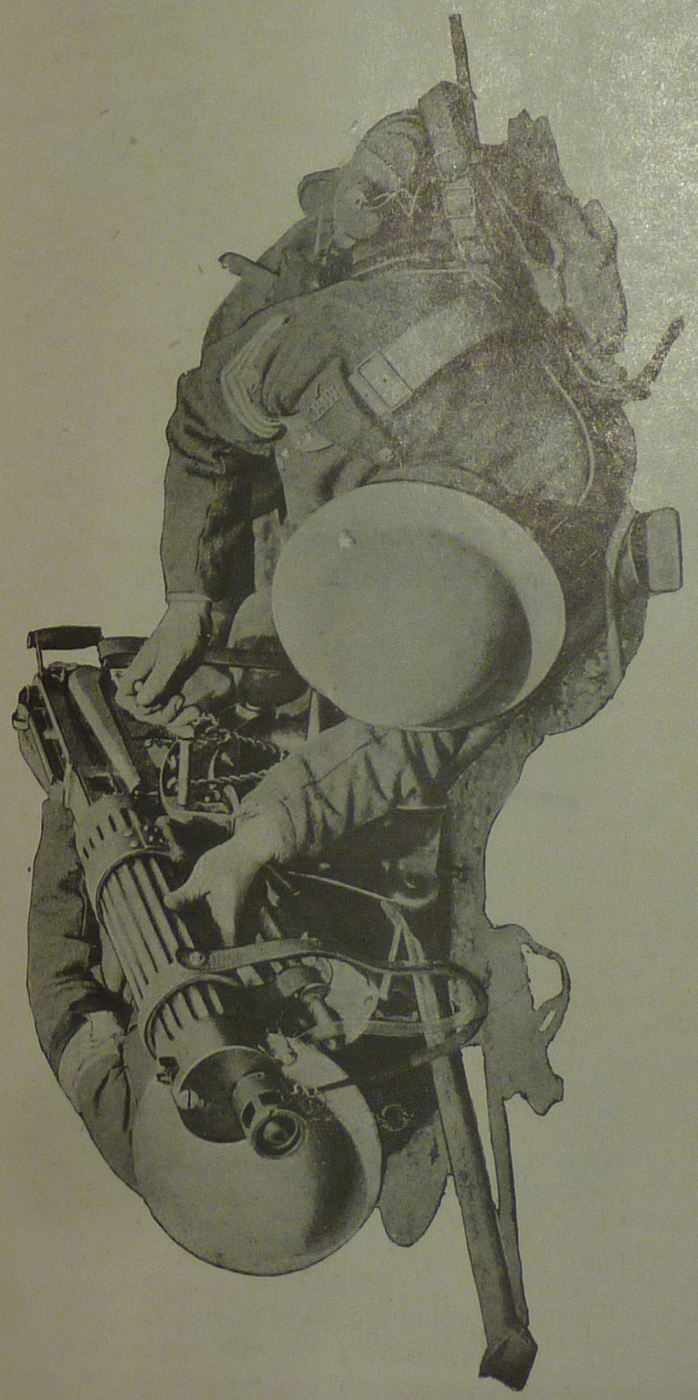


PLATE XIV.—ELEMENTARY DRILL—LOWEST POSITION—MOUNTING GUN.

Should any faults be detected, the instructor will point out what

Plate XV.—Elementary Drill—Lowest Position—Normal Firing Position.

(iii) The rate of movement should be such that the line of sight is moved about one yard in two seconds, when the target is 25 yards from the gun. The movement of the gun is almost imperceptible.

(iv) The thumbpiece should be pressed at the same time as the gun begins to move.

The instructor will give a demonstration, after which all the team will be exercised. The importance of the cross head being upright must be emphasised.

20.—Mounting and dismounting the gun in the lowest position.

When the men have made sufficient progress in the previous lessons, they will be taught how to bring the gun into action with the tripod mounted in the lowest position.

The system of instruction will be as described in all the earlier lessons.

It will be explained that the low position may be necessary when only low cover, or none at all, is available.

The instruction will be divided into three stages.

1st Stage.

When, before beginning, the tripod is folded in the usual way, *i.e.*, the rear leg set at a suitable angle for the normal sitting position.

On the command "Mount gun," No. 1 will carry the tripod to the position indicated, place it on the ground, lie down on the left of the tripod, and loosen all three jamming handles. He will then open the two short legs, raise the socket about one inch from the ground, and, keeping it upright, will clamp all three legs, clamping the rear one first. He will remove the elevating and cross-head joint pins.

No. 2 will open the sliding shutter, carry the gun to the position in the usual way, but just before lying down, will place the right arm under, instead of over, the barrel casing. He will then lie down and, assisted by No. 1, will place the gun on the tripod. (Plate XIV.)

No. 1 will put in the cross-head joint pin. No. 2 will put in the elevating joint pin, and pull out the cork plug. No. 3 will bring up the belt box in the usual way.

When the gun is mounted, No. 1 will lie with both legs on the left of the triped, right leg crossed over left, his back being supported by the right thigh of No. 2, and his neck being supported by the left knee of No. 2. (Plate XV.)

When the gun is mounted, the usual points will be criticised, and, in addition, note should be taken that the shoes of the tripod and

PRINTED IN FRANCE BY ARMY PRINTING

not the tubular portions of the legs are resting on the ground, and that the jamming handle of the rear leg does not interfere with the elevating wheel.

The gun will be dismounted in the usual way, except that all movements, prior to carrying the gun and tripod to the original position, will be carried out in the prone position.

2nd Stage.

When, before beginning, the rear leg of the tripod is set and clamped at an angle suitable for the lowest position.

The instruction will follow the same lines as in the first stage. It will not be necessary to loosen the jamming handle of the rear leg on reaching the position.

3rd Stage.

When, before beginning, the rear leg of the tripod is set at an angle suitable for the prone position, and when, in addition, the two front legs, instead of being folded alongside the rear one, are swung forward and upward, pointing in the air.

The instruction will follow the same lines as in the second stage.

4th Stage.—Use of the auxiliary mounting.

The instructor will explain that the auxiliary mounting is only intended to be used in an emergency, when the Mark IV tripod for some reason is not available, and that the gun can be mounted on the Mark IV tripod without removing the auxiliary mounting.

The gun can be carried by either one or two men, as desired.

(i) When carried by one man, the gun will be carried vertically on the right-hand side, muzzle upwards, the right hand grasping the rear leather band, back of the hand to the front, and taking all the weight; the left hand steadying the muzzle end by means of the light mounting clip.

(ii) When carried by two men, the leather straps, one on the rear crosspiece, and one on the front clip band, enable Nos. 1 and 2 to carry the gun between them.

When mounting the gun with the auxiliary mounting No. 1 will turn the gun on its left side, and No. 2 will open the tripod legs.

When the gun is mounted, the position of Nos. 1 and 2 will be the same as in the previous stages. (Plate XV.)

Section 24.—Tests of elementary training.

The following tests of elementary training have been devised to assist officers in testing theefficiency of their companies in elementary training, and also to ensure that no detail of such training is overlooked. It is important that these tests should not be considered

as competitions against time, for although quickness is necessary, accuracy is the first essential. No man should, therefore, be passed as efficient unless all the points are properly fulfilled, even though he may complete them in the standard time.

2. The tests must be carried out in strict accordance with the detailed instructions given, for unless the smallest details are insisted upon, the time limit will not be applicable. In carrying out these tests, time can be saved if the first pair complete tests 1 to 5 consecutively; the remainder can be carried out as convenient.

3. The entire personnel of a machine gun company, including the drivers when possible, should qualify in these tests, acting both as No. 1 and No. 2. This is necessary, for on service any member of a company may be required to replace a casualty at a moment's notice. In all tests No. 1 will repeat all orders received. The No. 1 should not be failed when, owing to the fault of No. 2, the time limit is exceeded. He must be tested again with a fresh No. 2.

4. No man will fire the Machine Gun Course until he has correctly passed these tests of elementary training. A record of these tests will be kept by each sub-section commander and produced for inspection by the company commander as required.

(i) **To erect the tripod and mount the gun on the command "Mount gun."**

Nos. 1, 2 and 3 will take post, lying down if the ground permits. The position where the gun is to be mounted to be not more than 5 yards away.

POINTS TO BE OBSERVED.—All the points given in Sec. 23, para. 6 (*c*).

STANDARD TIME—20 SECONDS.

(ii) **To load the gun on the command "Load."**

In continuation of (i)—Belt with a few dummy rounds at the end, properly packed in the box, which will be closed and fastened.

POINTS TO BE OBSERVED.—The gun to be correctly loaded; all loading motions to be quite distinct and correct, and to be carried out without any slurring.

STANDARD TIME—5 SECONDS.

(iii) **To adjust the sights and lay the gun on the command "(Range)—(Target)."**

In continuation of (i)—Gun loaded and ready to be laid. Three service targets will first be pointed out on a landscape target placed about 25 yards from the gun, but the No. 1 being tested will not

PRINTED IN FRANCE BY ARMY PRINTING

know which is to be given. Any range may be ordered, so long as it will not be necessary to alter the slide by more than 500 yards when adjusting for the range ordered. Before beginning, the tangent sight slide will be set at 1,000.

POINTS TO BE OBSERVED.—That the slide is adjusted and the gun laid with absolute accuracy. When the instructor is checking the aim No. 1 must maintain his "holding" pressure on the handles. No. 1 must be careful, however, that he does not exert lateral pressure when leaning to one side to clear the sights.

STANDARD TIME—8 SECONDS.

The time will be taken from the range being ordered until No. 2 holds up his hand, indicating that No. 1 is ready to open fire.

(ix) To unload the gun on the command "Unload."

In continuation of (iii).

POINTS TO BE OBSERVED.—Gun unloaded, tangent sight lowered, unloading motions to be quite distinct, belt withdrawn and repacked carefully in the box with lid closed and fastened; lock spring released.

STANDARD TIME—5 SECONDS.

(v) To dismount the gun on the command "Dismount gun."

In continuation of (iv). The gun will be dismounted and, together with the tripod and ammunition box, will be placed in the same position as at the beginning of test 1.

POINTS TO BE OBSERVED.—All the points as when "All correct" is reported before mounting gun.

STANDARD TIME—15 SECONDS.

(vi) To bring the gun into action on the command "Action," e.g., "900—Fir tree—Action."

This test combines (i) to (iii). It emphasises the necessity for proficiency in all details required before a gun can open fire with effect. This test should therefore not be applied until proficiency has been attained in each of those which precede it.

POINTS TO BE OBSERVED.—All points as laid down for tests (i), (ii) and (iii). When No. 1 is ready to open fire, No. 2 will hold up his hand.

STANDARD TIME—35 SECONDS. The time will be taken from the command "Action" until No. 2 raises his hand, indicating that No. 1 is ready to open fire.

25. Seconds loaded only

(vii) Horizontal traversing. On the command "Fire," e.g., 800—Horizontal row—Left figure—To fifth figure from left—Traversing—Fire."

The target will be as for the Machine Gun Course, Practice 1, placed at 25 yards from the gun. The gun will be laid on any figure that may be ordered. The tangent sight will be raised, but the firer must keep his eyes directed at the target during the traverse. The tests will comprise traversing from RIGHT to LEFT as well as from LEFT to RIGHT. When the gun is laid, the aim should be checked by the officer conducting the test. On the command "FIRE," No. 1 will fire a group at the figure named, then traverse, so that the next group will be fired at the space between that figure and the next; the subsequent groups will be fired at a figure and space alternately. The test will not be completed until the space between 5 figures inclusive has been traversed. In order to ensure that the traversing is satisfactory throughout, the order to cease fire will be given at least once during the traverse, but not before 5 groups have been fired, and the laying will be checked; this will be repeated when the limit of the traverse is reached.

POINTS TO BE OBSERVED.—That No. 1 tested his tap before beginning the test; the object is to test if No. 1 has acquired the correct automatic tap; the gunner will not pass the test if more than one tap out. Tapping backwards to correct errors will not be allowed. By counting the number of taps, the correct point of aim can be calculated, *e.g.*, if fire be opened on the first figure, and stopped after the sixth tap, the gun should then be laid on the fourth figure.

STANDARD TIME—2 SECONDS FOR EACH COMPLETE SERIES, *i.e.*, one second for a group and one second for a tap. This time is the minimum; the total time must not be exceeded by more than 5 seconds.

(viii) Searching. On the command "Fire," e.g., "800—Vertical row—Bottom figure—To 1,300— Searching —Fire."

The target will be as for the Machine Gun Course, Practice 1, placed on end at 25 yards from the gun.

The procedure will be as for (vii) "Searching" being substituted for "Traversing." The tests will comprise searching up and searching down.

POINTS TO BE OBSERVED.—The object is to test if No. 1 has acquired the correct automatic turn of the wheel. The gunner will not pass the test if more than one turn of the wheel out. Turning the wheel backwards, to correct errors, will not be allowed. By counting the number of turns, the correct point of aim can be calculated as in (vii). When the aim is being checked the tangent sight slide should be adjusted to the initial range.

PRINTED IN FRANCE BY ARMY PRINTING

STANDARD TIME—5 SECONDS FOR EACH COMPLETE SERIES, *i.e.*, four seconds for a group and one second for a turn of the wheel. This time is the minimum; the total time must not be exceeded by more than 5 seconds.

(ix) **Oblique traversing.** On the command "Fire," e.g., "800—Oblique row—Left figure—To fifth figure from left—Traversing—Fire."

The target will be as described in Sec. 23, para. 18, placed at 25 yards from the gun.

The procedure will be as for (vii), but in this test manipulation of the elevating wheel is included and the firer is allowed to look along his sights. The tests will comprise traversing from RIGHT to LEFT, as well as from LEFT to RIGHT. The gunner will not pass the test if more than one tap out.

POINTS TO BE OBSERVED.—As in test (vii).

STANDARD TIME—5 SECONDS FOR EACH COMPLETE SERIES, *i.e.*, three seconds for a group, one second for a tap, and one second for a turn of the wheel. This time is the minimum; the total time must not be exceeded by more than 5 seconds.

(x) **Immediate action.**

In this test the man will be required to rectify correctly each of four different stoppages within a certain time. These stoppages will be set up to simulate—

	Position.	Standard time.
(1) Weak charge	1st ...	10 sec.
(2) Damaged cartridge	2nd ...	15 „
(3) A cross-fed cartridge	3rd ...	10 „
(4) A missfire	4th ...	10 „

A target should be indicated to the whole squad previous to the test. The crank handle should be covered with a cloth to conceal its position. On the removal of the cloth for covering the crank handle, the No. 1 will perform the immediate action.

Time will be taken from the moment the cloth is removed to the moment that the thumbpiece is pressed for reopening fire. The immediate action must be correctly performed and the gun accurately relaid. The order in which stoppages are set up should be varied.

(xi) **Belt filling.**

(*a*) A heap of 25 rounds of ball ammunition will be placed beside a man, and these will be inserted in a belt.

STANDARD TIME—1 MINUTE.

(*b*) As for (*a*), but 250 rounds are to be inserted in a belt by one man.

STANDARD TIME—12 MINUTES.

POINTS TO BE OBSERVED.—Rounds to be placed in a heap and not arranged. Inspection of the belt on completion will show if it has been filled correctly.

Section 25.—Combined drill—Direct fire.

Instructions in Machine Gun Signals (Sec. 20) will be given before combined drill is carried out, and these signals should henceforth be used whenever possible.

Combined drill is best carried out with four or more guns. An officer will control the drill, and a N.C.O. will supervise each gun team. The N.C.O. will take times and carefully note the performance of each detail: he will not assist the gun team, nor give any instructions unless so ordered. When the state of the ground permits, all numbers should lie down, Nos. 3 and 4 forming a short chain of supply, and the remainder continuing the chain, or representing reserves to replace casualties.

The purpose of combined drill is to increase proficiency in elementary drill and to provide practical instruction in the following subjects:—

(i) The delivery and execution of fire orders. This opportunity should be taken of practising officers and non-commissioned officers in fire control.
(ii) Immediate action.
(iii) The replacement of casualties and breakages.
(iv) The supply of ammunition, oil and water.

Kit required for each gun team.—Gun fitted with auxiliary mounting and with the barrel casing filled, tripod, two belt boxes and belts with dummies, spare parts box complete, condenser tube * fitted to gun, condenser bag half filled with water, and landscape target.

* NOTE.—On all occasions during training, except when firing, a dummy condenser tube should be used to prevent the metallic tube being damaged. The dummy tube can be made by attaching a union joint to a six feet length of half-inch rope.

1st Stage.

The teams will be exercised in all the movements of elementary drill up to and including "Action" and "Out of action," in both the normal and lowest positions. Practice in the use of the auxiliary mounting will also be given. Fire orders should be simple, and alterations in sighting elevation and targets should be practised.

2nd Stage.

In addition to the points mentioned in the first stage, the fire orders should include the use of traversing, searching and combined sights (Sec. 21).

3rd Stage.

Before this stage is carried out, immediate action and repairs and adjustments must have been practised in the mechanical training on the gun.

In this stage service targets in the open country will be used.

In addition to the points mentioned in the previous stages, practice should be given in :—

Immediate action.
Replacing casualties and breakages.
Ammunition, oil and water supply.

Section 26.—Combined drill—Indirect fire.

In order that a section may work in the field with efficiency the methods of indirect fire must be learnt as a drill. This will enable the personnel in action to reproduce automatically the movements learned in practice, with such modifications as the conditions of battle may impose.

1.—Kit required for each gun team.

Gun and tripod.
Bar foresight.
Belt boxes (4), belts and dummies.
Condenser tube and bag.
Clinometer.
Cleaning rod.
Spare barrel and spare parts box.
"T" shaped base, sandbags and shovel.
Two posts—the "zero post" and the "aiming post" (these should be of different colours).
A shutter is also required for controlling fire.

Guns and tripods will be laid out as in elementary drill. A gun commander will be appointed for each gun.

2.—"Fall in."

Teams will fall in as in Elementary drill, gun commanders on the right of Nos. 1, teams in line.

The section commander will indicate the reference object (if one is being employed).

3.—"Number."

As in Elementary drill.

4.—"Take post."

As in Elementary drill. No. 3 has with him a condenser bag, four belt boxes, and the posts. No. 4 has the "T" shaped base, shovel, sandbags, spare barrel, and spare parts box. The gun commander takes post on the left of No. 1, and has the cleaning rod, clinometer and bar foresight.

5.—"Tell off by guns."

The gun commanders number off from the right; "No. 1 gun," &c.

6.—"Prepare for action."

No. 1 examines the tripod, and No. 2 prepares the gun (condenser tube fixed) for action. No. 3 inspects the ammunition. No. 4 doubles forward with the "T" shaped base and shovel. Nos. 5 to 8 are spare men, and remain under cover.

The section commander indicates the alignment of the "T" shaped bases, and on his signal No. 4 fixes the bases firmly in the ground and doubles to the rear.

7.—The section must now be laid on parallel zero lines. All methods of doing this should be practised. When a reference object is used in front of, or behind the section, the drill will be as follows :—

(i) **"Flank guns—Mount gun."**

The flank guns are mounted and laid on each other. No. 2 of each gun notes the reading on the direction dial and signals with his hand to the other No. 2 when this is done. Both guns now lay on the reference object, and the angle swung through is noted. These angles are passed along to the section commander, who then calculates the distribution angle to obtain parallel lines.

(ii) "**Remainder—Mount gun.**"

The remaining guns are mounted and laid on the reference object. No. 3 of each gun brings up two belt boxes and the condenser bag. Nos. 4, 5 and 6 bring up sandbags and Nos. 2 and 3 ensure the firm bedding of the tripod legs. No. 2 places the condenser tube inside the bag. The gun commander fits the bar foresight on to the gun.

(iii) The angle of distribution from the reference object necessary to bring all guns on to parallel lines, followed by the angle of switch from the reference object necessary to bring all guns on to parallel zero lines will now be passed to each gun commander, either verbally (para. 20) or in writing.

The angle of distribution will be laid off by means of the bar foresight and the angle of switch by the direction dial.

(iv) When the gun has been laid on its parallel zero line, the gun commander will adjust the bar foresight to zero. No. 3 will then pace out 10 yards from the cross head and drive in the zero post. In this he will be directed by No. 1, who will adjust the tangent sight slide to bring the line of sight on to the post.

The zero post will not be moved once the gun has been laid on its parallel zero line.

8.—"**Stand clear.**"

The teams will fall in 5 yards in rear of the guns and stand at ease.

9.—"**Stand to.**"

All numbers take up their positions. The gun commander kneels down with the cleaning rod and clinometer on the left of No. 1.

10.—Orders for change of direction from the zero line (if necessary) to engage the first target, followed by the elevation, will be given verbally (*see* Note 1) or in writing.

Whenever possible these and subsequent orders for changes of direction and elevation should be given in writing in the form of a gun chart.

When the angle of deviation from the zero line does not exceed 7 degrees it can be laid off from the zero post by means of the bar foresight, in which case there will be no need to place out the aiming post.

The gun commander will place the elevation on the gun by means of the clinometer.

When direction and elevation have been placed on the gun, the gun commander will report "No. 1 Gun ready," &c.

11.—"**Load.**"

As in Elementary drill.

12.—"**Traverse.**"

Will be 2 degrees, *i.e.*, 1 degree right and 1 degree left, unless otherwise ordered. No traverse is required for concentration.

13.—**Rate of fire.**

Slow, medium, or rapid.

14.—"**Fire.**"

The shutter will be lowered. Bursts of fire should not be less than 15-20 rounds. No. 1 relays between bursts, and, unless concentrating, traverses between bursts. *Accuracy in relaying must always be insisted on.*

15.—"**Cease fire.**"

Shutter released.

Procedure after first lift or first belt, whichever is the shorter:—

No. 1 unloads and clears gun.
No. 2 removes the outer casing, tests the muzzle cup, cleans the barrel, and replaces the outer casing.
No. 3 brings up ammunition.
No. 1 oils up, reloads, and lays for direction.
Gun commander puts on elevation.
No. 2 signals "ready to fire."

Procedure after every 1,000 rounds:—

No. 1 unloads and clears gun.
No. 2 cleans the barrel and replenishes the water in the barrel casing, if necessary.
No. 3 brings up ammunition.
No. 1 oils up, reloads, and lays for direction.
Gun commander puts on elevation.
No. 2 signals "ready to fire."

16.—"**Unload.**"

As in Elementary drill. The gun commanders report "No. 1 gun clear," "No. 2 gun clear," and so on.

17.—" Out of action."

The guns will be dismounted at the firing point. Nos. 3, 4, 5 and 6 will double forward and retire with the equipment.

18.—Sections should be practised in coming into action in different positions, obtaining parallel lines by different methods, and firing by charts. In the latter case, verbal orders should be dispensed with as far as possible.

In the final stages of training, section commanders should be practised on the ground from the map of the district in applying the fire of their sections to any target with rapidity and accuracy. Throughout the drill, gun numbers must be changed round frequently.

19.—Practice with ball ammunition should be carried out on a short range. A method of preparing targets for use in this case is as follows :—

(i) Work out the angles of direction and elevation required for each task.

(ii) Place each gun about 20 yards from a white 6-ft. screen. Lay for each task, look along the barrel and note at what points on the target the bullets should strike. Mark these points and the limits of traverse on each target. Sketch in trench lines, strong points, &c.

(iii) If the exercise is to be carried out by day, a screen should be erected between the gun and target.

In this way the gunners may be rehearsed in firing a barrage which they will later have to fire in an attack.

Attention must be paid throughout to all points of elementary training and drill.

20.—**Examples of verbal orders.**

The left gun will always be the directing gun.

(*a*) DISTRIBUTION.

(i) To obtain parallel lines.

"**Distribute 20 minutes.**"—This is the angle obtained by the section commander in para. 7. The angle 20 minutes has been used simply for the purpose of illustration. The same applies to all other angles. This order will be passed down as follows :—

The gun commander of No. 4 gun repeats the order, and the laying of No. 4 gun is not altered.

The gun commander of No. 3 gun repeats "20 minutes right—Distribute 20 minutes," and No. 3 gun is laid off 20 minutes to the right of the reference object by means of the bar foresight.

The gun commander of No. 2 gun repeats "40 minutes right—Distribute 20 minutes," and the gun is laid off 40 minutes to the right of the reference object by means of the bar foresight.

The procedure for the other gun is similar to the above.

The guns are now laid on parallel lines, and can be swung on to their zero lines as follows :—

"**All guns—Degrees right (or left).**"

Each gun commander repeats the order and the gun is laid off the given angle from the reference object on the direction dial.

The guns are now laid on parallel zero lines.

(ii) To engage a target.

"**All guns on zero lines.**"

The gun commander repeats the order. No. 1 lays on the zero post.

"**All guns—Degrees right (or left).**"

The gun commander repeats the order. No. 1 lays off the given angle on the direction dial. No. 3 paces out 10 yards from the crosshead and, directed by No. 1, drives in the aiming post.

"**Distribute 20 minutes.**"

The procedure is the same as in (i) except that the aiming post is here used instead of the reference object.

(*b*) CONCENTRATION. To engage a target.

"**All guns on zero lines**"—as in (*a*) (ii).

"**All guns—Degrees right (or left)**"—as in (*a*) (ii).

"**Concentrate 20 minutes.**"

The gun commander of No. 4 gun repeats the order and the laying of No. 4 gun is not altered.

The gun commander of No. 3 gun repeats "20 minutes left—Concentrate 20 minutes," and No. 3 gun is laid off 20 minutes to the left by means of the bar foresight.

The procedure for the other guns is similar to the above.

(*c*) ELEVATION.

(i) "**Elevation 3 degrees.**"

Each gun commander repeats the order and lays the gun to that elevation with the clinometer. No. 1 adjusts the tangent sight slide to bring the line of sight on the aiming post and notes the reading on the sight.

PRINTED IN FRANCE

(ii) "**Elevation 4 degrees—Add 20 minutes.**"

The gun commander of No. 4 gun repeats the order and lays the gun to 4 degrees with the clinometer. No. 1 proceeds as in (i).

The gun commander of No. 3 gun repeats "Elevation 4 degrees 20 minutes—Add 20 minutes," and lays the gun to 4 degrees 20 minutes with the clinometer. No. 1 proceeds as in (i).

The procedure for the other guns is similar to the above.

(iii) "**Elevation 5 degrees—less 10 minutes.**"

The gun commander of No. 4 gun repeats the order and lays the gun to 5 degrees with the clinometer. No. 1 proceeds as in (i).

The gun commander of No. 3 gun repeats "Elevation 4 degrees 50 minutes—Less 10 minutes," and lays the gun to 4 degrees 50 minutes with the clinometer. No. 1 proceeds as in (i).

The procedure for the other guns is similar to the above.

ADVANCED GUN Drill this will consist of
1 Drill over rough ground
2 Elementary tactical drill

Section 27.—Rough ground drill.

The object of this drill is to train the team in bringing the gun into action on rough ground. Practice will be given in mounting the gun on a steep slope, firing in any of the following directions :—

(i) To the front or rear.
(ii) To the right or left.
(iii) Up hill.
(iv) Down hill.

The drill should be taught individually by the instructor.

The kit required is the same as for combined drill, except that a belt box carrier is required, but not a landscape target.

The instruction will be divided into two stages as follows :—

1st Stage.

In this stage no targets are indicated, and the use of cover is not practised.

The instructor will show how the tripod is erected for all kinds of slopes and he will point out that :—

(i) The rear leg must always point down the slope.
(ii) The socket must be upright.
(iii) Only the shoes of the tripod must touch the ground.

Each member of the team will then be exercised in erecting the tripod on a different position.

The instructor will then demonstrate the duties of No. 2 by mounting the gun on the tripod so as to fire in the required direction. He will also demonstrate the use of the belt box carrier, and other means of placing the belt box so as to ensure a correct feed.

Each member of the team will then be exercised in mounting the gun on the tripod to fire in different directions. (Plates XVI and XVII.)

NOTE.—It is often more convenient after the tripod has been erected, but before the crosshead is swung round in the direction of the target, to have the gun mounted, and *then* swung round. By doing this, the task of No. 2 is easier than when the gun is mounted *after* the crosshead has been turned.

2nd Stage.

In this stage ranges will be given, targets indicated, and full use made of cover. No attempt should be made to introduce tactical lessons.

Nos. 1, 2, 3 and 4, with the gun, tripod, &c., will be in a position of readiness, not more than 10 yards from the selected gun position. The remaining numbers will be sent out as observers in the direction of the target, and will criticise the movements of Nos. 1 and 2 as regards exposure when coming into action.

The instructor will mark a position, give the range, indicate the target, and then order "Action."

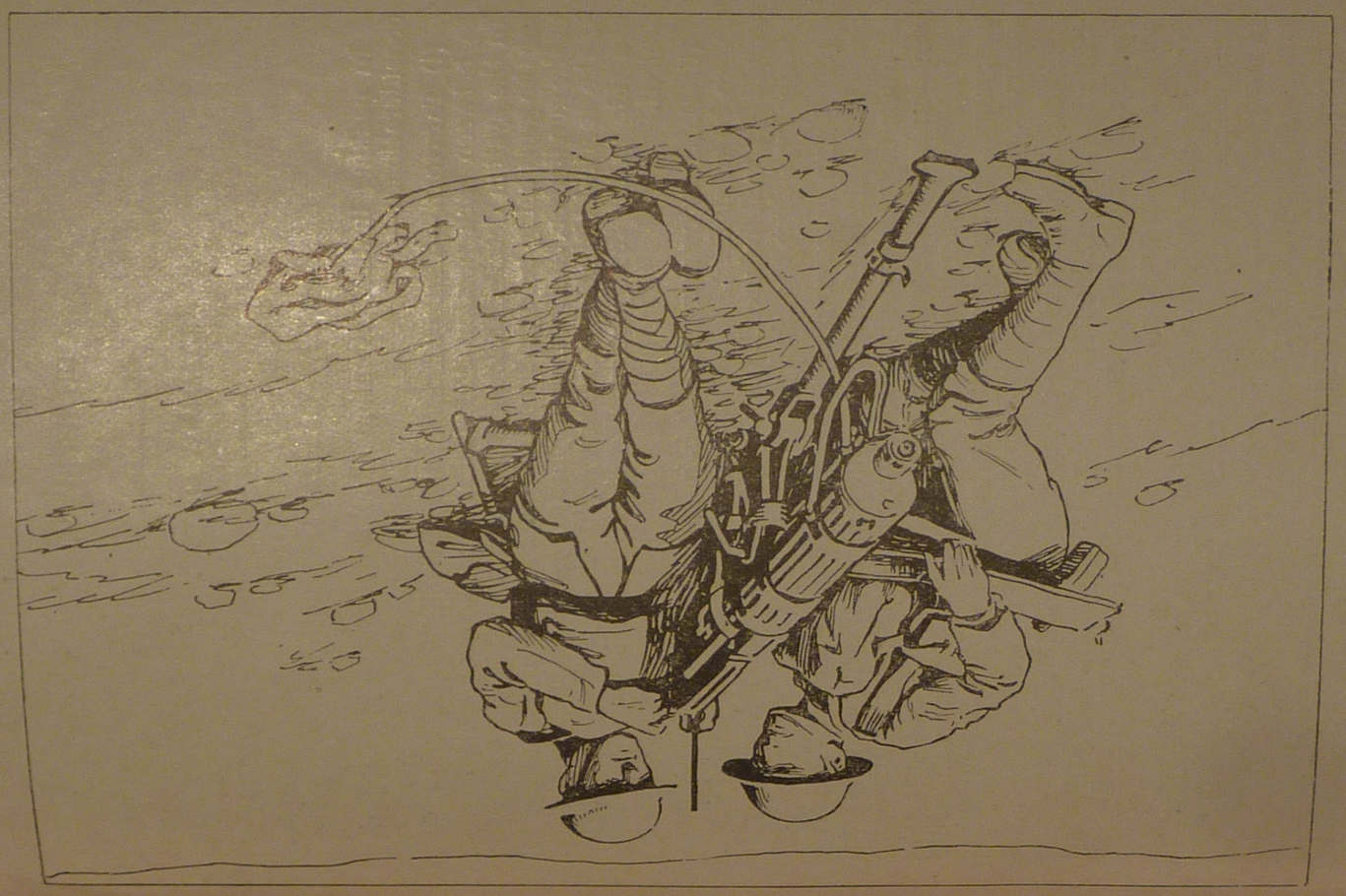
The following points should be criticised after No. 2 has raised his hand to indicate that the gun is in action :—

(i) Whether there was any unnecessary exposure whilst the gun was being brought into action.
(ii) Whether the gun is properly in action, and all the details of elementary training have been observed.
(iii) Whether the fire would clear any existing obstruction.
(iv) The correct erection of the tripod, with the rear leg downhill.
(v) Whether the tripod had to be altered after the gun was mounted.
(vi) The positions adopted by Nos. 1 and 2 as regards exposure and comfort.
(vii) The position of the belt box to ensure correct feed.
(viii) The position of No. 3 (minimum exposure, within view of the gun, and with ease of ammunition supply).
(ix) The position of No. 4.

When the men have made sufficient progress in the above, they should be practised in arranging and clamping, under cover, the position of all three legs (before mounting), so that the socket will be upright when the tripod is mounted on the position indicated.

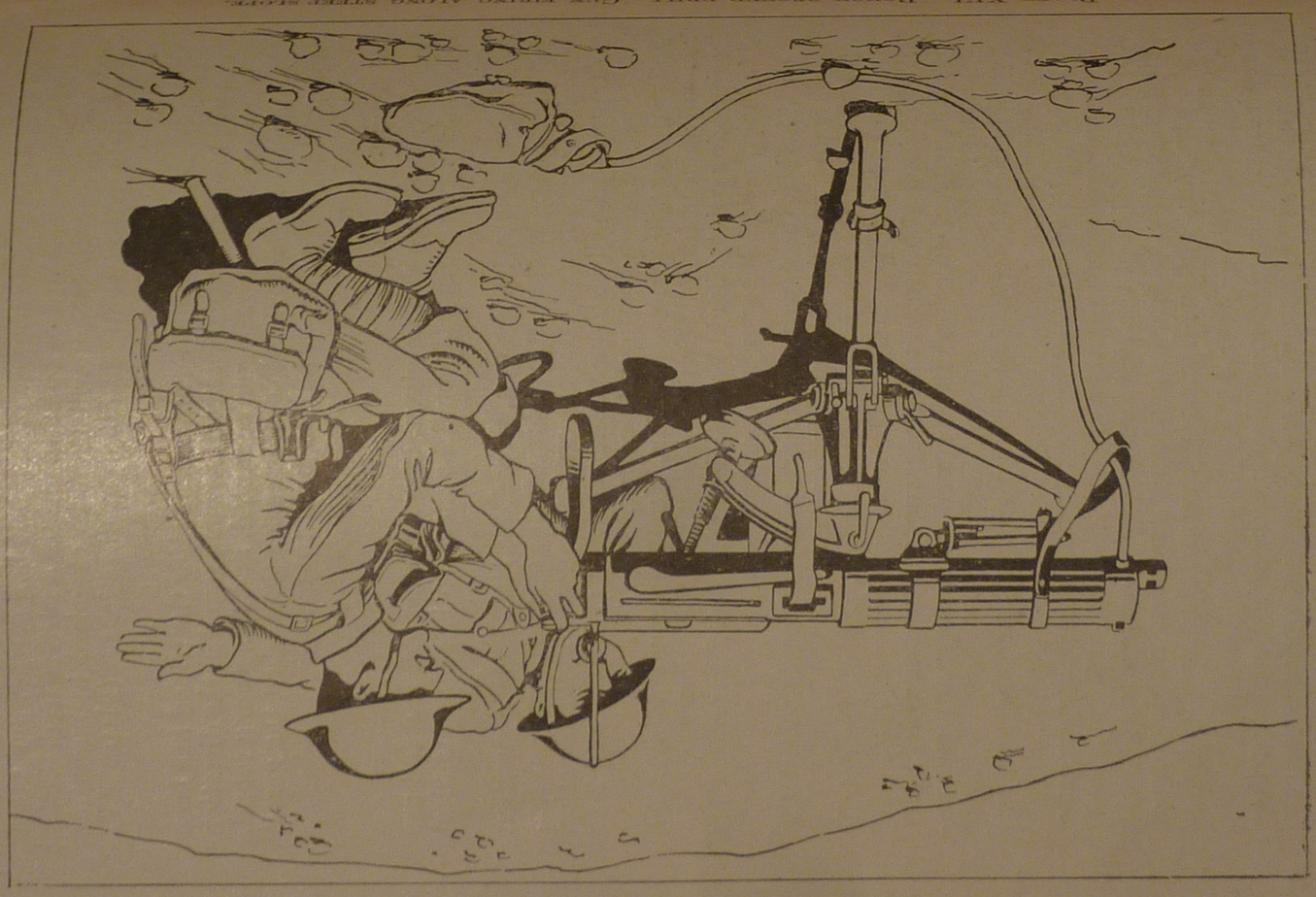
PRINTED IN FRANCE BY ARMY PRINTING

PLATE XVII.—ROUGH GROUND DRILL—GUN FIRING DOWN STEEP SLOPE.



(15179) c 2

PLATE XVI.—ROUGH GROUND DRILL—GUN FIRING ALONG STEEP SLOPE.



CHAPTER V.

LIMBER DRILL.

Section 28.—General instructions.

In packing limbers attention should be paid to the following considerations :—

(i) TACTICAL.—These will affect the distribution of the loads both as between each portion and as between the limbers themselves. In the system detailed below all equipment and supplies necessary for the guns being brought into action are carried in the fore portion of the gun limber, and further supplies are carried in the hind portion. If the tactical situation demands rapid action a few gun numbers can ride in the fore portion, the hind portion being unhooked, if desired.

(ii) BALANCE OF LIMBERS.—It is important, if galls on the animals are to be minimised, that the load in each portion of the limber should be well balanced. Also, the fore portion should carry a heavier load than the hind portion.

(iii) SPEED IN COMING INTO ACTION.—In order that the guns may come into and out of action as rapidly as possible, it is necessary for all ranks to know exactly where every article is carried, and for the gun numbers to be well drilled in packing and unpacking the gun limbers. A uniform system should be adopted throughout the company, and in every section a corporal should be detailed to supervise the packing of the limbers correctly.

In this chapter, a drill for packing the gun limbers is given. The drill will be carried out at the double. The tailboard of the fore portion should never be lowered when the hind portion is attached and the animals are hooked in.

The pack saddlery will be carried on the off-side animals, with the exception of the hangers and racks (carried in the hind portion of the gun limber), and the water boxes or tins (carried in the fore portion of the gun limber).

When the packs of the officers, warrant officers, N.C.Os. and men are carried on the limbers they should be distributed between all three limbers, the importance of balance being kept in mind.

Section 29.—Packing limbers.

The equipment, as shown in the load tables (gun limber) Sec. 31, will be dumped in rear of the limber.

"Fall in."

The sub-section (excluding drivers) will fall in immediately in rear of the limber, in two ranks.

"Number"—as in elementary drill.

"Pack limber."

(i) FORE PORTION (Plates XVIII and XIX).

On the command "Pack limber," the Nos. 1 and 2 double to the dump, take three belt boxes each, and place six on each side of the limber, upright, the side of the box touching the side of the limber, arrowhead pointing inwards.

Immediately the belt boxes are in position the Nos. 3 and 4 place the gun chests on top, one on either side of the limber, hinges towards the sides of the limber.

The Nos. 1 will then follow with the Mark IV tripods, condensers and condenser tubes, placing the tripods in the centre of the limber, crossheads touching the tailboard, and as close to each other as possible. The condenser bags and tubes will be placed on top of the legs of the tripods.

No. 2 of the right team will bring up two spare parts boxes and place them in the front end of the limber, one on top of the other, slightly to the off side, hinges to the rear. At the same time No. 2 of the left team will bring up two belt boxes and place one on each side of the limber, upright, next to the middle belt box on the floor of the limber.

No. 3 of the right team packs the auxiliary mountings on the floor space, one on each side of the Mark IV tripods. No. 3 of the left team packs the oil can cases in the space on the near side against the spare parts boxes.

No. 4 of the right team packs the water boxes or tins, upright against the rear of the spare parts boxes. The other No. 4 packs the trench machine gun bags between the Mark IV tripods and gun chests, one on each side.

All numbers 1 to 4 of each team place the cover on the limber, the right team on the off-side and the left team on the near side.

(ii) HIND PORTION (Plates XX and XXI).

On the command "Pack limber," No. 5 of the right team places the water drum and hay nets in the front off corner, hay nets on top of the drum. The other No. 5 places the four horse rugs against the front end of the limber, and touching the drum.

No. 6 of the right team brings up the signal pistols, folding saw, periscopes (Vigilant) and bag line gear (filled with mallet, pegs, picketing, &c.), placing the bag line gear in the front near corner, and the pistols, periscopes and folding saw on top of the four horse rugs. At the same time the other No. 6 will place one canvas rack (containing three belt boxes), lengthways, on the near side of the limber, touching the bag line gear, lids to be against the near side of the limber.

No. 7 of the right team will place the two metal carriers (each containing one belt box) upright, and as far forward as possible on the off side, touching the water drum and horse rugs. The other No. 7 will place one canvas rack on the near side, lengthways, in rear of the one already packed.

The Nos. 8 place two canvas racks as far forward as possible, the ends touching the off-side of the limber.

The Nos. 5 pack two S.A.A. boxes, on end, at the rear of the limber, one on each side.

No. 6 of the right team packs the bullseye lanterns and pickets alongside the canvas racks on the off-side. The other No. 6 packs the tools on the floor space, heads to the rear.

No. 7 of the right team places the horseshoe valise against the S.A.A. box on the off-side. The other No. 7 packs the sandbags on top of the horse rugs, and two canvas buckets on top of the bag line gear.

No. 8 of the right team places the two hangers on top of the metal carriers. The other No. 8 places the two drivers' packs in the centre.

All numbers 5 to 8 of each team place the cover on the limber, the right team on the off-side and the left team on the near-side.

Section 30.—Action from limbers.

"Action."

On the command "Action," Nos. 1 to 4 of each team double to the limber (the right team on the off-side, the left team on the near side) and remove the covers from the limber.

The Nos. 1 take the tripods and carry out their normal duties on the command "Action."

The Nos. 2 and 3 remove the guns from the chests.

The Nos. 3 take out the spare parts cases, and hang them over the shoulders of their Nos. 2, who then double out with the guns and condenser tubes to their Nos. 1.

The Nos. 3 each take two belt boxes, and carry out their normal duties on the command "Action."

The Nos. 4 half-fill the condenser bags double out, each with a condenser bag and one belt box, and lie down under cover.

The corporal then moves the limber to cover, the Nos. 5, 6, 7 and 8 accompanying him.

"Out of action."

On the command "Out of action," the corporal moves the limber up to the most convenient position for the guns coming out of action, consistent with the safety of the animals.

The Nos. 3 and 4 repack the belt boxes under the gun chests, open the gun chests and tidy the limber.

The Nos. 4 take the condenser tubes off the guns as soon as the Nos. 2 arrive with them.

The Nos. 2 and 3 replace the guns in the chests, close the lids, and the Nos. 2 hand the spare parts cases to the Nos. 3 to replace in the limber.

The Nos. 1 repack the tripods, and the Nos. 4 repack the condenser bags and tubes.

All numbers 1 to 4 of each team replace the cover on the limber, the right team on the off-side and the left team on the near-side.

Section 31.—Load tables.

NOTE.—The following load tables should be considered as a guide only and not as definite instructions, owing to the necessity of adapting the loads to suit local conditions.

Gun Limber—Fore Portion.

Articles.	No.	Approximate weight. lbs.
Bags, trench, machine gun	2	10
Belts, ammunition, in single boxes (filled)	14	294
Boxes, spare parts and tools (filled)	2	44
,, or tins, water (filled)...	2	38
Cans, lubricating, No. 9 (filled)	4	6
,, half-pint (filled)	4	4
Cases, cans, oil (also containing spare joint pins, cross-head, two, and elevating, two)	2	6
Condensers, steam (bag and tube, with union joint) ...	2	4
Guns, Vickers, complete, filled with water, each with cork, plug, muzzle protector, cleaning rod and spare barrel, in chests	2	160
Mountings, auxiliary	2	16
,, tripod, Mark IV, with dials	2	104
Rifles of two drivers, with covers	2	20
Load, fore portion	...	706

NOTE.—When the section is on the march, the clinometers will be carried by the gun commanders.

PRINTED IN FRANCE BY ARMY

Fighting Limber—Hind Portion.

Articles.	No.	Approximate weight. lbs.
Axes, pick, heads and helves	2	12
Bag, line gear (containing mallet, brushes, rubbers, etc.)	1	15
Bags, sand, common	30	12
Belts, ammunition, in single boxes (filled)	14	294
Cartridges, S.A.A. ball	2,000	150
Buckets, water, G.S., canvas	2	1
Carriers, ammunition belt box	2	10
Drum, oil, containing spare supply of water (filled) ...	1	37
Hangers, gun and tripod	2	17
Lanterns, bullseye, and iron pickets	2	10
Nets, hay	4	2
Packs of two drivers	2	30
Periscopes, No. 18 (Vigilant)	2	(½)
Pistols, signal, 1 in.	2	4
Racks, boxes, ammunition in belt	4	24
Rugs, horse	4	40
Saws, folding, complete	1	2
Shovels, G.S.	2	7
Shoes, horse or mule, with nails, in valise	8	12
Load, hind portion	...	679
,, fore portion	...	706
Total load	...	1,385
Wagon, limbered, G.S., equipped	...	1,262
Total loaded fighting limber	...	2,647

Ammunition Limber—Fore Portion.

Articles.	No.	Approximate weight. lbs.
Bar, supporting draught pole, No. 3 (spare)	1	10
Cartridges, S.A.A. ball	7,000	525
Cartridges, ball, pistol, Webley (reserve)...	156	8
Kettles, camp, oval, 12 quarts	4	36
Machine, filling belt, in chest	1	42
Swingletree, No. 13 (spare)	1	7
Rifle of driver, with cover	1	10
Load, fore portion	...	638

Ammunition Limber—Hind Portion.

Articles.	No.	Approximate weight. lbs.
Axe, felling, curved helve	1	4
Bag, line gear (containing mallet, brushes, rubbers, etc.)	1	12
Buckets, water, G.S., canvas	2	1
Cartridges, S.A.A. ball	7,000	525
File, regular cut, 12 in., with handle, middling	1	1
Hooks, bill	1	3
Knives, opening tins	2	1
Megaphone, 10 in.	1	1
Nets, hay	2	1
Packs of section officer and driver	2	30
Periscope No. 18 (Vigilant)	1	¼
Rugs, horse	3	30
Shoes, horse or mule, with nails, in valise	4	6
Stand, signalling, telescope	1	4
Load, hind portion	...	619
,, fore portion	...	638
Total load	...	1,257
Wagon, limbered, G.S. equipped	...	1,262
Total loaded ammunition limber ...	...	2,519

NOTE.—If a Barr & Stroud range-finder is issued to the section, the case may be carried in the ammunition limber—hind portion. When the section is on the march, the instrument will be carried by one of the gun team; it should on no account remain on the limber, as the jolting will cause it to become out of adjustment. The case is provided for the care of the instrument when not on the move.

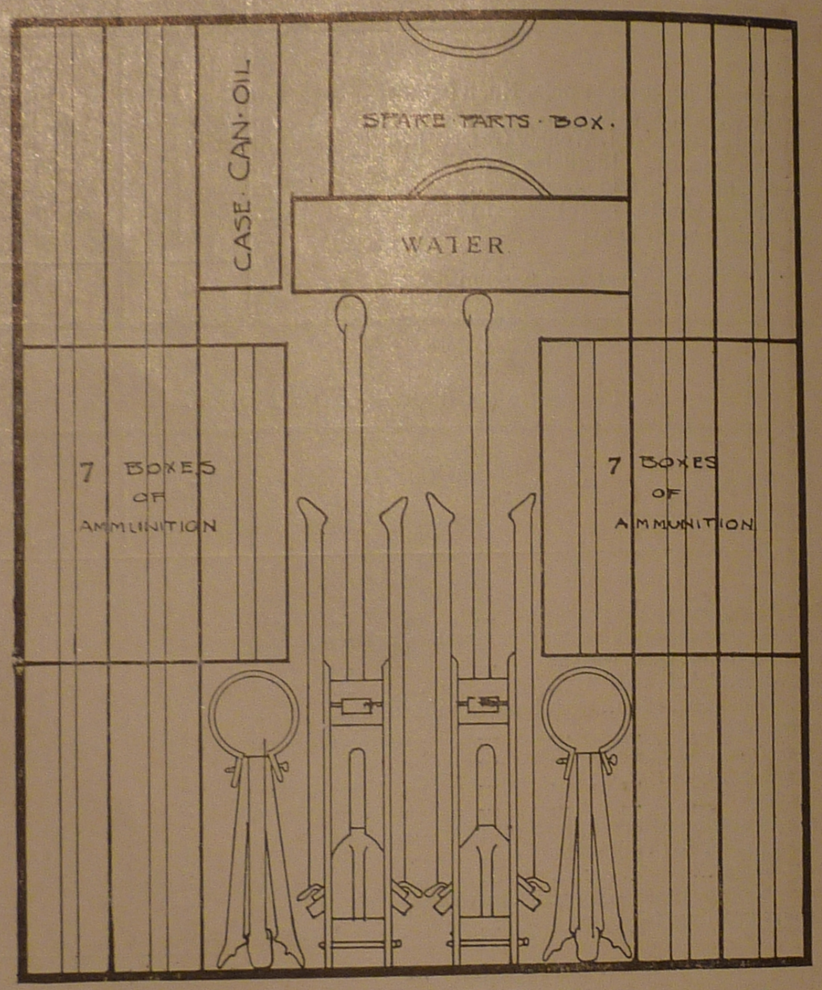


PLATE XVIII.—GUN LIMBER—FORE PORTION—BOTTOM LAYER.

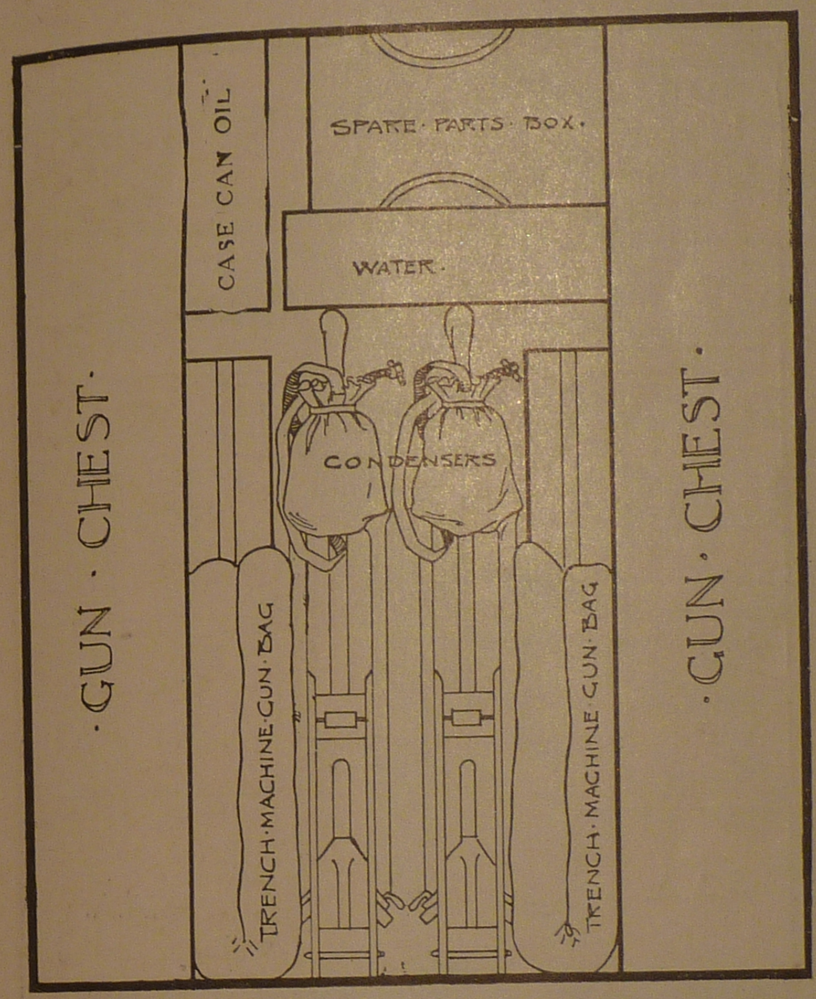


PLATE XIX.—GUN LIMBER—FORE PORTION—TOP LAYER.

PRINTED IN FRANCE BY ARMY

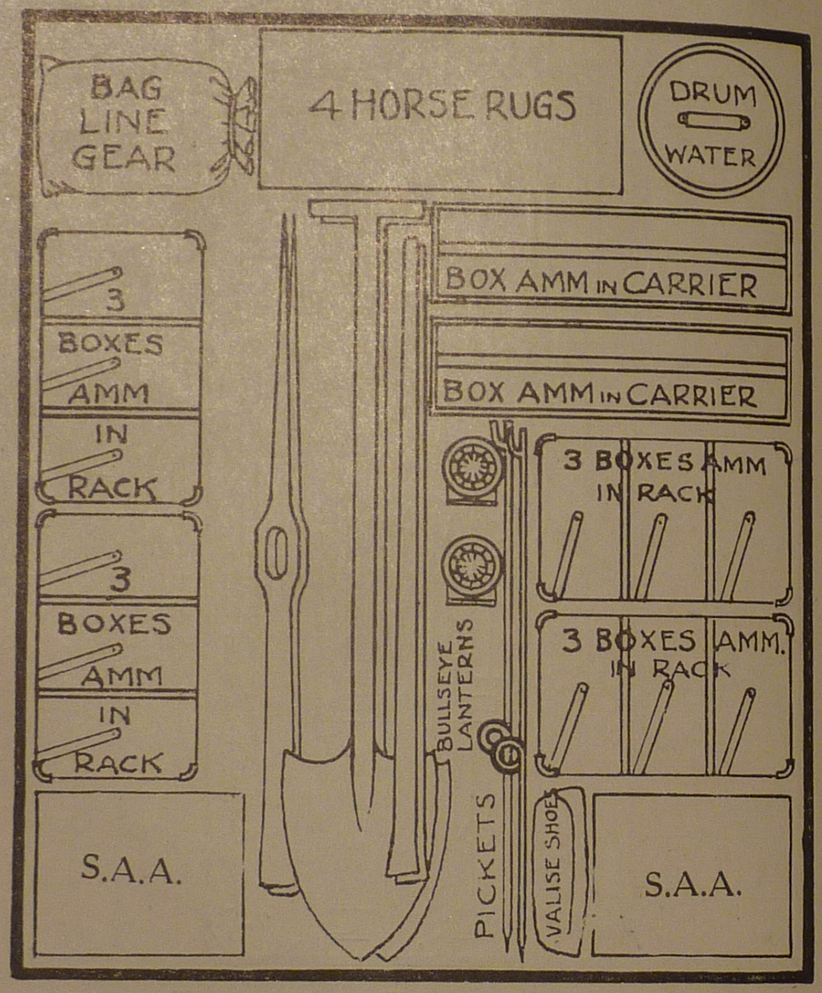


PLATE XX.—GUN LIMBER—HIND PORTION—BOTTOM LAYER.

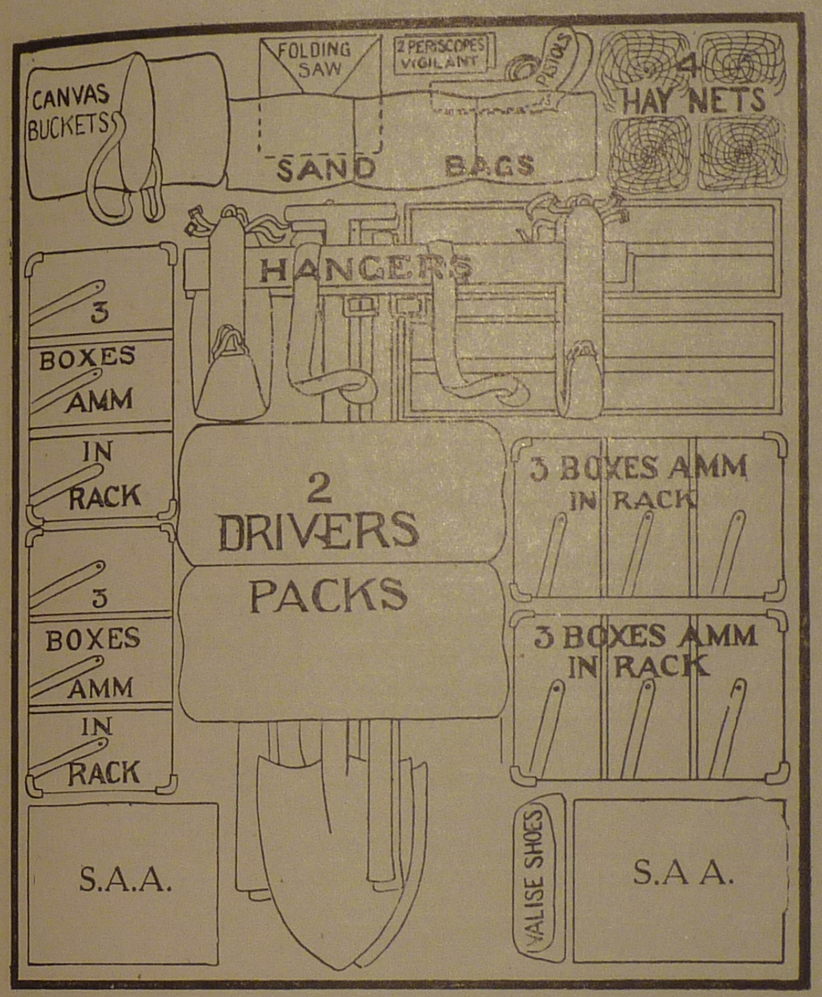


PLATE XXI.—GUN LIMBER—HIND PORTION—TOP LAYER.

CHAPTER VI.

PACK SADDLERY DRILL FROM LIMBERS.

Section 32.—General instructions.

When it is found necessary to use pack animals instead of limbers, the two lead animals will become pack animals, the near-leader carrying the ammunition pack and the off-leader the gun and tripod pack.

Each gun team should be practised in the following drill, for which purpose the team will consist of Nos. 1 to 8, No. 8 acting as leader of one pack animal.

To prevent alarming the animals the drill will be carried out in quick time, not at the double.

NOTES.—(i) For details of sets and description of gear *see* Handbook for the ·303 in. Vickers' Machine Gun, Sec. XVI. The hanger with two narrow slings, used in this drill for the gun, is officially known as the hanger, tripod, sling; and the hanger, with one wide and one narrow sling, used for the tripod, is officially known as the hanger, gun, sling.

(ii) The girths can be greatly improved by attaching a narrow strap about 20 inches long to the centre of the front girth, and a buckle to the centre of the rear girth. By connecting the girths in this way the rear girth is prevented from slipping back. An additional security can be given by cutting a slot in the "lay" on the pannel to allow the girth strap to pass through it.

Section 33.—Loading pack saddles.

"Fall in."

On the command "Fall in," the sub-section (excluding drivers) will fall in immediately in rear of the limber, in two ranks.

"Number"—as in elementary drill.

"On pack saddles."

On the command "On pack saddles," the drivers of the fighting limbers move up and unhook the leaders, No. 8 moves up and holds the leaders. The brakesman puts on the brake, moves up and holds the wheelers. The driver of the near leader takes off his own saddle, blanket, breeching, traces and breast collar, and places them in the front portion of the limber. The driver of the near-wheeler takes off the pack saddle, two feeds and blanket from the off-wheeler, and puts the feeds in the rear-portion of the limber; with the assistance of the other driver he puts the saddle and blanket on the near-leader, takes off the breeching, traces and breast collar from the off-leader, and puts them in the front portion of the limber.

At the same time Nos. 1 and 2 take off the cover of the front portion, and Nos. 3 and 4 the cover of the rear portion of the limber, and all the gun team, employed as below, remove the necessary gear and equipment required for the packs, so that the drivers can place their harness in the limbers.

(i) GUN AND TRIPOD PACK (Plates XXII and XXIII). Numbers required—1, 2, 5 and 6.

Nos. 5 and 6 will take the hangers from the rear portion of the limber, and place them on the pack saddle (off-leader), No. 5 placing the gun hanger (hanger with two narrow slings) on the off-side and No. 6 the tripod hanger (hanger with one wide and one narrow sling) on the near-side of the pack saddle.

No. 6 unties the feeds and replaces one, passing the strap of the nosebag over the near hanger and under the front girth.

No. 5 takes the canvas water bucket and puts it between the front and rear arch of the saddle, the rope handle going under the rear arch and on to the rear off-hook of the tree. No. 5 also takes the spare parts case out of the spare parts box and passes the strap of the spare parts case under the bar of the hanger and over the front near side hook; this avoids undoing the strap.

Nos. 1 and 2 take out one tripod and gun, and fix the auxiliary mounting on the gun.

No. 1, having undone the strap on the legs, takes the tripod, and with the assistance of No. 6, places it in the near-side slings, legs to the rear, crosshead leaning on the front arch. Nos. 1 and 6 buckle the securing straps. The tripod must be further attached by passing the strap on the legs through the "D" on the rear of the hanger, and then round the sling before buckling. Care must be taken that the inner jamming handle is turned back on to the leather panel of the saddle.

No. 2 takes the gun, and with the assistance of No. 5, places it in the off side slings, muzzle to the rear, the front sling being passed over the feed block and the rear sling between the auxiliary mounting and the barrel casing. Nos. 2 and 5 buckle the securing straps. No. 5 takes the cleaning rod and pushes it through the gun slings, front to rear, where the metal rings are held by the leather slings.

No. 6 takes the water box or tin, and places it between the arches of the saddle.

The Nos. 1 and 2 fix the straps, long and short, which are on the bars of the hangers, round the tripod legs and gun respectively, and buckle them on to the belly bands.

(ii) AMMUNITION PACK (Plate XXIV). Numbers required—3, 4 and 7.

No. 7 takes a canvas water bucket and puts it on as above, and places the other feed from the off-leader on top of the saddle, resting between the front and rear arches, and strapped round the centre of the rear arch.

PRINTED IN FRANCE BY ARMY PRINTING

Nos. 3 and 4 take a full ammunition rack each and hang them on to the hooks, the metal "D" on the bottom of the rack being nearest to the animal, and the lids of the boxes being away from the animal.

They now fasten the steadying strap (leather girth), each end, when long enough, being passed through the slot in the "lay on" of the pack saddle, through the metal "D" on the rack and then buckled.

No. 3 takes the oilcan case and places it between the arches of the saddle, with the strap round both arches.

No. 4 places the condenser tube and condenser bag in the centre of the saddle, securing the sling to the front arch. The condenser tube can be fixed on the gun in the "ready position," if required.

Wire cutters, if likely to be required, should be carried attached to the front arch of the pack saddle. Both packs are loaded simultaneously.

The gun team can now move off, the leading driver leading the ammunition pack animal, and No. 8 the gun and tripod pack animal.

"Off pack saddles."

On the command "Off pack saddles," the reverse procedure will be adopted.

Section 34.—Action from pack saddles.

"Action."

On the command "Action," the gun numbers will carry out their duties as for the command "Off pack saddles," combined with their normal duties on the command "Action." They will only remove those articles which are actually required from the packs.

The driver and No. 8 will assist each other to secure all loose gear and straps after the gun team moves off.

In the case of ammunition packs, care will be taken that the same number of belt boxes are removed from each rack, so that the remainder of the load is balanced.

Section 35.—Load tables.

NOTES.—The following Load Tables should be considered more in the nature of a guide than as definite instructions, owing to the necessity of adapting the loads to suit local conditions.

It is most essential that the weights be kept as equal as possible on each side. If, for example, the nosebag be empty or the barrel casing be not full of water, or some belt boxes have been emptied, these facts should be taken into consideration and weights adjusted accordingly.

GUN AND TRIPOD PACK.

Near side.	lbs.	Centre.	lbs.	Off side.	lbs.
Tripod, with dials ...	52	Water	19	Gun with barrel	
Hanger, gun, sling ...	9	Bucket, canvas ...	1	casing filled ...	42
Nosebag (with feed) ...	8	Case, horseshoe	3	Hanger, tripod, sling	8
		(filled)		Auxiliary mounting	8
				Spare parts case ...	8
				Cleaning rod ...	1
Total	69	Total ...	23	Total ...	67

Recapitulation of weights.

	lbs.
Near side	69
Centre	23
Off side	67
Packsaddle and blanket ...	34
	193

AMMUNITION PACK.

Near side.	lbs.	Centre.	lbs.	Off side.	lbs.
3 boxes, belt (single) ...	63	Case, can, oil ...	8	3 boxes, belt (single)	63
Rack (canvas)	6	Bucket, canvas ...	1	Rack (canvas) ...	6
		Nosebag (with feed)	8		
		Case, horseshoe (filled)	3		
		Condenser tube and bag	3		
Total	69	Total ...	23	Total ...	69

Recapitulation of weights.

	lbs.
Near side	69
Centre	23
Off side	69
Packsaddle and blanket ...	34
	195

PLATE XXIII.—PACK SADDLE—GUN AND TRIPOD PACK—OFF SIDE.

PLATE XXIV.—PACK SADDLE—AMMUNITION PACK.

CHAPTER VII.

TRAINING IN FIELD OPERATIONS.

Section 36.—Elementary tactical ~~exercises~~ drill.

Before ~~these exercises are~~ this drill is carried out the following should have been given :—

(i) A short lecture on the characteristics of the machine gun.
(ii) A demonstration in the use of cover from view, both natural and artificial, followed by practice in concealing gun positions.
(iii) A short lecture on reconnaissance, especially with reference to the selection of gun positions.

(For the above, *see* The Tactical Employment of Machine Guns.)

~~These exercises will include all the details of training which a machine gun section should receive from the section officer.~~ If the exercises are carefully prepared and executed, the section officer on service will be relieved from the necessity of supervising the detailed execution of his orders, and will be left free to devote his attention to the general situation, while retaining control of the movements and actions of his guns.

These exercises form a link between rough ground drill & the tactical handling of M.Gs in the field.

The exercises ~~will be divided into two stages as follows :—~~ should be carried out on the lines of the following example.

1st Stage.—Exercise with one gun.

This stage forms a link between rough ground drill and the tactical handling of machine guns in the field. It is designed to give practice to gun numbers in the following :—

(i) Reconnaissance.
(ii) The use of cover in :—
  (*a*) The approach to the gun position.
  (*b*) The gun position itself.
(iii) The method of approach to the gun position as regards the carrying of the gun, tripod, &c. Concealment will be considered of greater importance than rapidity, within reasonable limits.
(iv) Provision of a chain of supply under cover.
(v) Proficiency in rough ground drill.

The kit required is the same as for rough ground drill, but four belt boxes should be provided in order that ammunition supply may be practised ; ~~a belt box carrier should be used.~~

Preliminary arrangements.

The value of the exercise will depend upon the suitability of the ground selected. The ground must permit of the following :—

(i) A frontage of about 50 yards, containing only one suitable gun position, under cover, from which the target is visible.
(ii) A position of readiness about 50 yards in rear of the gun position.
(iii) A covered line of approach.
(iv) A position about 100 yards to a flank from which the target is visible.

The target must be of a service character, and have a different aspect from positions (i) and (iv). It should be reasonably difficult to recognize from the gun position.

The exercise will be carried out as follows :—

(i) Explain the objects of the exercise to the section.
(ii) March the section to the position of readiness.
(iii) Detail Nos. 1, 2, 3 and 4 to each of the four guns.
(iv) Detail an officer or N.C.O. to accompany each team and to note criticisms on the actions of the various gun numbers.
(v) Define the limits within which the teams may manœuvre.
(vi) Order Nos. 2, 3 and 4 to remain at the position of readiness, and march the remainder, including Nos. 1, to position (iv) described above.
(vii) Call up Nos. 1, give the range, indicate the target, and order them to return to the position of readiness and await orders.
(viii) Give the range and indicate the target to the remainder of the section. Observers should be sent out to note the visibility of the gun and team in approach, in mounting, and in action. The remainder of the section should follow and criticise the gun teams from a flank.
(ix) Signal "Action" to the first gun team.
(x) After the gun is in action, the supervising officer will call for criticisms, in turn, from the observers, the remainder of the section, and the officer or N.C.O. detailed to accompany the team.

Points for criticism.

(i) Whether No. 1 before starting gave the remainder of the team the range and a full description of the target, so that it might still be engaged should he become a casualty.

(ii) Whether No. 1 made a careful reconnaissance, keeping under cover, and selected the position from which the target is visible.
(iii) Whether No. 1 indicated the target to the remainder of the team from a position under cover (but not at the gun position) if this was possible.
(iv) The actions and positions of the other numbers, especially as regards the use of cover and the chain of supply.
(v) Whether all the points of elementary training and rough ground drill were correctly carried out.

The same procedure will be carried out with each team of the section in turn. Occasionally the No. 1 should be made a casualty during his advance to the gun position.

This stage should be practised subsequently over different ground, and the gun numbers changed round.

2nd Stage.—Exercise with two guns.

In this stage an entire sub-section is exercised on the same progressive lines as teams in the preceding stage. All ranks will be exercised in their respective duties. The general situation must necessarily be somewhat amplified in ordered to employ scouts and rangetakers in a realistic manner. Ranges should actually be taken. If a limbered wagon is not available it should be represented by a hand-cart, with a corporal in charge.

Ammunition supply will be carried out, empty boxes being passed back for refilling. The replacement of casualties and breakages will be practised, but this must not be carried to an extreme. The points to be attended to in the previous stage should be carefully observed. As proficiency increases, practice should be given in exercises which require rapid action such as changes of targets and changes of gun positions to meet surprise situations.

Preliminary arrangements.

The position of readiness should be at least 300 yards from the gun position, and should be selected with a view to making more difficult the advance, reconnaissance, and selection of gun positions. The frontage should be about 200 yards wide, and should contain several possible gun positions.

The exercise will be carried out as follows :—

(i) Explain the objects of the exercise to the section.
(ii) The complete sub-section will fall in at the position of readiness.
(iii) Detail an officer to accompany each team and note criticisms. Observers should be sent out as in the first stage.
(iv) The supervising officer will take out the scout, explain to him a simple situation and indicate the target.

PRINTED IN FRANCE BY ARMY PRINTING

(v) Signal the sub-section to advance.

(vi) Order the scout to return and report the situation, &c., to the sub-section officer.

(vii) If the situation demands rapid action, the time should be taken from the return of the scout until the sub-section is in action.

(viii) Explain the situation to the other sub-section, which should watch the exercise.

Points for criticism.

(i) The officer.—Whether he appreciated the position accurately and quickly, and decided rapidly upon a course of action.

Whether he explained the situation to the sub-section before starting his reconnaissance, and what orders he gave.

Whether he took forward with him his scout and rangetaker, and also his serjeant if he thought fit.

The nature of his reconnaissance and the approximate positions selected for the guns and for the limber, and what action he took as to the selection of alternative positions.

The fire orders given and the fire control.

(ii) The serjeant.—Whether he selected the exact gun positions with due regard to cover and field of fire, and his subsequent actions.

(iii) The corporal.—Whether in the absence of orders, he halted the limber as near to the gun positions as cover would permit.

Whether he made arrangements for keeping in touch with the guns, and for supply.

(iv) The scout.—The report he made; his use of cover when bringing up the sub-section; whether he observed the movements of the enemy and of our own troops; and his subsequent actions.

(v) The rangetaker.—The position from which he took ranges; his exposure while doing so; the range card made; and whether he subsequently tried to observe fire.

(vi) The gun numbers.—The points of criticism (iv) and (v) as in the first stage.

(vii) The time taken to come into action, when the situation renders this important.

Subsequent training in this exercise should be given to each sub-section over different areas. The gun numbers should be changed round on each occasion.

Section 37.—Advanced tactical exercises.

1. The elementary tactical exercises should be followed by more advanced exercises in which the section will be practised over wider areas in the various operations of war. Before each exercise is begun the section officer will explain its purpose and the principles that will be followed in carrying it out, and, on its conclusion, detailed criticism will be made. In this way the rank and file should gradually be trained in elementary tactical principles, and their initiative encouraged and developed along sound lines.

2. Attention should be paid in every exercise to the general principles of machine gun employment (The Tactical Employment of Machine Guns) and also to the following points:—

(i) Use of limbers.—The fullest possible use should be made of limbers for the rapid conveyance of guns and men. In open warfare machine guns will often be required to act ahead of the main body of the infantry, in order to grip on to tactical points already gained by advanced troops. It will often be necessary for machine guns to move faster than the infantry—for instance, a machine gun company, marching near the head of the main guard of an advanced guard, may be required to push ahead and hold ground to cover deployment. Similarly, during "bounds," when infantry have gained an objective, machine guns are required to push on quickly to that objective. On such occasions where the ground is suitable, and the tactical situation permits, limbers should be used for the rapid conveyance of guns and men.

Where the line of approach is concealed from the enemy, limbers should be brought up as close as possible in the first instance. But as soon as the limbers have been unloaded they should be sent back to a suitable position far enough away to avoid shell-fire directed at the guns. On the other hand, if safe cover (such as a quarry or very steep slope) exists close behind the gun position the limbers may remain there.

In a situation where it is absolutely essential to get into action without a moment's delay, and where the nature of the ground permits of no alternative, limbers should be driven boldly up to the gun position, quickly unloaded, and as quickly driven away to suitable cover.

Limbers must not bunch together. They should be kept at least 40 yards apart whenever they are on ground which may be subjected to hostile fire. Touch must be kept between the limbers and the guns when the latter are in action.

PRINTED IN FRANCE BY ARMY PRINTING

(ii) DRILL.—Drill must not be divorced from tactics. After the gun position has been selected and the order has been given to bring up the guns, application of drill is required in getting the guns into action. The danger of the teams bunching together when advancing from the limbers to the gun position, which may be partly due to the bunching of limbers mentioned above, must be avoided.

Broadly speaking, except in the case of a fleeting target, when it will be expedient to open fire at once with the first gun to get into action, a section commander will wait until all his guns (or at any rate three of them) are ready to open fire before he gives the signal to do so. A systematic arrival of the various numbers at the gun position should be aimed at. Undue haste, which will only lead to confusion, should be avoided. Teams must be well under control when going into action, and such control should be exercised by the N.C.O. at the limbers. There is need for quick action, but it must not be allowed to degenerate into a scurry, and there should be no shouting.

Generally speaking, crawling should be confined to movement over the last few yards in approaching a position. When longer distances must be covered, in possible view of the enemy, it is better to make a bold dash right up to the gun position, simulating the movement of infantry as much as possible.

Officers must constantly practise giving fresh fire orders and switching their guns from one target to another. Nos. 3 and 4 must actually go through the movements for replenishment of ammunition, &c.

(iii) PROTECTION.—The principle that every unit is responsible for its own protection, must be impressed upon all ranks, and practice must be given in the methods of protection to be employed. The measures against surprise which have been taken when the guns are on the move must not be relaxed when the guns are in action. Protection of the flanks is of special importance, and a sentry must always be posted to watch any locality from which the gun position may be turned.

(iv) FIRE AND MOVEMENT.—Although the principle that, during the attack, movement should be covered by fire, does not apply so much to the movement of machine guns as to the action of infantry in the fire fight, nevertheless, this principle must be thoroughly understood and often applied by machine gun officers. Methods must, of course, be adapted to the tactical situation at the

moment, and to the task in hand, but, in many situations, where two sections are detailed to act together, and it becomes necessary to move from one position to another, one section should move, covered by the fire (if necessary) of the other section. The latter should only leave the original position when the section which moved first is in the new position. The same method also applies to sub-sections, acting singly, and should generally be adopted by a group of machine guns which has been detailed for the protection of a flank, in addition, perhaps, to other duties.

(v) Formations to be adopted in battle (Infantry Training, Sec. 118).

(vi) Chain of supply, dumps, &c.

(vii) Communication, both by signal and runner.

(viii) Fire orders and fire control.

3. The more realistic the scheme, the greater will be the impression made by the lessons learnt. Whenever possible, the enemy should be represented by pole targets, if men are not available. For this reason tactical exercises in the form of Field Practices (Sec. 41) are particularly valuable.

4. Schemes should also be framed for the purpose of training machine gun officers in the tactical principles laid down in Field Service Regulations, Part I; Infantry Training; and The Tactical Employment of Machine Guns. These exercises should be prepared in detail with maps, instructions and points for criticism. They should involve the rapid appreciation of a situation, the selection of the most appropriate method of fire direction, the issue of orders, the sending of situation reports and the rapid preparation of sketch maps. The actual presence of guns on such tactical schemes is of value in order to test, to some extent, the feasibility of the execution of the orders given. Their presence, however, is not essential for the conduct of the exercise.

5. The subsequent training will be carried out whenever possible with other troops. Frequent co-operation between machine guns and other arms is of the utmost importance, for by this means only can all ranks obtain a sufficient knowledge of the tactics of those with whom it will be their duty to co-operate on the field of battle.

In cases when co-operation with the infantry cannot be obtained, officers must train and use their imagination in picturing what their own infantry are doing in the situation with which they are dealing at the moment. Officers directing an exercise must constantly picture to company and section commanders the movements of their own infantry. Training the imagination is of the utmost importance, but it must be based on sound knowledge. The commander who lacks imagination will also lack ability to divine the intentions of his opponents.

PRINTED IN FRANCE

Section 38.—Posting and relief of sentries.

1. The object of this instruction is to give practice in :—

(i) Posting and relieving sentries, and Nos. 1.
(ii) Relief of sections.
(iii) Coming into action from cover.
(iv) Quick changes to alternative positions.
(v) Duties in case of "gas alert."
(vi) Duties in case of an alarm.

2.—Kit required :—

Gun (barrel casing filled with water) and auxiliary mounting.
Condenser tube and condenser, half filled with water.
Mark IV tripod.
Two belt boxes (6, if available), belts and dummies.
Spare parts case.
Auxiliary aiming mark.
Clinometer.
Periscope.
Range card.
Sentry order board.
Machine gun trench bag.
Water box, or tin.
Signal pistol (not to be fired near the gun position).
Box respirators.

3.—Posting and relief of sentries by day.

The following procedure will be carried out when relieving sentries within a gun team :—

The principles involved are identical with those for the posting and relief of a sentry on guard or outpost duty.

By day, one gun number only need be on duty at the gun position ; he is the sentry.

He will always be posted by a N.C.O., who will explain the orders to him, and be certain that these orders are understood. The sentry should be in possession of a periscope.

The tripod and two belts in boxes will be in the position ; the remainder of the team and equipment will be under cover.

The sentry will be given the following details and orders :—

(i) Definite orders as to his action in case of attack.
(ii) Exact location of all gun positions allotted to his gun, and their numbers or names.
(iii) Points shown on the range card, and extent of the front to be watched.
(iv) In case of alarm, to warn the commander and team.

(v) Standing orders for sentries ; special orders for the gun position.
(vi) Special information—*i.e.*, patrols, wiring parties, positions of forward saps, danger from snipers, the position of our own and hostile infantry, &c.
(vii) Positions of guns on either flank.
(viii) Position of the officer.
(ix) Position of the nearest telephone and latrine.

4.—Posting and relief of sentries by night.

By night double sentries will always be posted, one being the No. 1 for the tour of duty. Both will be near the gun and on the look-out.

The gun will be mounted in the position, half loaded and laid on the night line. Four belt boxes and the spare parts case will be in the position.

The posting of the double sentries will be performed by a N.C.O., who will make certain that the sentries understand their orders.

Each No. 1, after being posted, will inspect the gun to make certain that it is in thorough working order and ready to open fire on completion of the loading motion. He will see that all necessary equipment is in place, and will be informed of any special fire orders for night firing from the position.

If there is a loophole, he will ascertain whether it has been cleared.

Note.—All sentries, both by day and night, will also act as gas sentries.

5.—Relief of sections.

The guide with the relieving section will lead it to the position of the section to be relieved, and report to the commander of that section that the relieving section has arrived.

(*a*) The officer in charge of the relieving section will :—

(i) Report to the officer of the section to be relieved.
(ii) Remain with him and receive reports from his N.C.Os.
(iii) Receive any instructions or information with regard to the situation, other than those he has learnt during his previous reconnaissance.
(iv) As soon as the relieved section has moved off he will go round all his guns and make sure that his gun commanders have carried out their work correctly. At the same time he will see that any special orders he may have issued with regard to work to be done, &c., are being complied with.

PRINTED IN FRANCE

(v) Report "Relief complete" to his machine-gun company commander, and to the infantry commander of the trench sector.

(vi) See that his arrangements for communication are on a satisfactory basis.

(*b*) The relieving N.C.O. will :—

(i) Ascertain the positions of the guns and the sentries, alternative emplacements, his officer's headquarters, the nearest telephone and latrine. He will also ascertain the night line for each gun.

(ii) Take over and give a receipt for trench stores.

(iii) Ensure that his No. 1 understands his orders and range card, and show him the alternative emplacements.

(iv) Detail his first sentry, and see that he is properly posted.

(v) Order his No. 1 to mount his tripod (and gun, if relief is by night), and see that this is done correctly.

NOTE.—When the relief is by night precautions must be taken that the incoming gun is laid on the correct line.

(*a*) If the tripod of the outgoing gun can be left in position, and the tripod of the incoming gun handed over in exchange, direction can be obtained by laying the incoming gun to the same direction dial reading; elevation can be put on by the clinometer. If an auxiliary aiming mark has previously been put out, and is visible by night, the incoming gun can be given the correct direction and elevation by being laid upon it with the stated tangent sight reading.

(*b*) If tripods cannot be exchanged, an auxiliary aiming mark may be used as in (i), care being taken to mount the incoming tripod at the same height as the last one, or the gun may be laid by any of the methods employed in indirect fire.

(vi) Report to his officer "Relief complete."

(vii) Draw out a duty roster.

(*c*) The relieving sentry will ascertain :—

(i) The orders for the sentry as detailed in paras. 3 and 4.

(ii) Whether the gun has been fired during the previous relief.

(iii) If so, at what target, and from what emplacement.

(*d*) The officer in charge of the section relieved will not move off until his section is reported closed up and complete.

6.—Duties in case of the alarm "Gas" or "Gas shells."

(i) All ranks will adjust their box respirators. The gun and spare parts will be well oiled.

(ii) BY DAY.—On the alarm being given, the sentry gives the alarm to the other numbers, takes the gun to the emplacement, mounts it, loads and lays. No. 2 follows immediately with two ammunition boxes (or one double box) and the spare parts case; the remaining numbers stand by in the dug-out.

When "stand to" is ordered, the above procedure is carried out by the machine gun teams, except that the gun is only half-loaded.

The loop-hole (if blinded) will have to be cleared before fire can be opened; the actual moment when this should be done depends on the nature of the situation.

(iii) BY NIGHT.—On the alarm being given, No. 1 completes the loading motions. The other sentry will waken the other numbers, and return to his post.

Practice should be given in mounting the gun on the auxiliary mounting in alternative positions, to represent the Mark IV mounting having been destroyed. Practice will also be given with the pivot and ammunition box mountings.

7.—Action during and after a gas attack.

(i) During a gas attack :—

(*a*) The gun will be kept firing, or

(*b*) The gun, ammunition boxes, and spare parts case will be completely covered with ground sheets or blankets.

(ii After a gas attack, the gun, its equipment and the ammunition will be thoroughly cleaned. (Handbook for the ·303 in. Vickers Machine Gun, Sec. V, para. 11.)

CHAPTER VIII.

MACHINE GUN COURSE.

Section 39.—General instructions.

NOTE.—All references to plates in this Chapter refer to Sub-headings of Plate XXV.

1. The Machine Gun Course will not be fired until the machine gunner has passed the tests of elementary training (Sec. 24).

2. The machine gunner will not be considered a "trained" gunner until he has qualified in the firing of the Machine Gun Course.

3. The range duties as laid down in Musketry Regulations, Part I, Sec. 91, apply equally to the firing of the Machine Gun Course, and must be strictly observed. In addition, the following safety precautions must be taken :—

(*a*) No gun will be loaded until the senior officer present has ordered the practice to begin.

(*b*) Before the red flag is raised at the firing point, signifying cessation of fire, the senior officer present will give the order "Clear guns," when the firer will remove the lock from the lock guides, stand up and report "Gun clear." The lock will remain in this position until the order "Load" is given.

4. The following arrangements will be made at the firing point :—

The senior officer conducting the firing will take up the most suitable position, preferably central, according to the number of guns on the range.

Having issued his instructions for the firing, &c., he will move to and fro along the line of guns, supervising the procedure.

He alone is responsible for issuing orders for raising and lowering the firing point red flag, also for authorising the orders to open fire and cease fire.

Platoon and section officers at the firing point will act similarly in respect of issuing their instructions to, and supervising their respective platoons or sections.

They will ensure that the firing point registers are properly kept.

The officer in charge of the left-hand section may give the signals to fire and cease fire for the whole line of guns, under the orders—by signal or otherwise—of the senior officer conducting the firing ; or in the discretion of the latter, each section officer may (subject to the flag which governs the whole firing point) be allowed to carry on independently for his own section.

5. Attention is directed to Musketry Regulations, Part I, Chapter VI, paras. 442, 447, 454 and 465 to 470 (both inclusive).

6. The Machine Gun Course is divided into five parts :—

Part I.—Instructional.

„ II.—Observation and Classification Range Practices.

„ III.—Fire at long ranges, observation of the fire of a section, tests and demonstrations.

„ IV.—Field practices.

„ V.—Tactical exercises to be carried out under instructions issued by G.O.C. Division (or in case of Cavalry Regiments by G.O.C. Cavalry Brigade).

6A. It is essential that the mounting and gun should be such as to enable the standard group (3 in. ring, containing 9 shots out of 10) to be obtained. This will be tested in the presence of the firers, before Part I is fired, in the following manner :—

(i) Range, 25 yards. Target, any convenient vertical screen. Rounds, 10 (one burst of fire).

(ii) The tripod will be erected on firm ground. On bad ground a T-base should be used. Experience has shown that the firing of only 10 rounds will not be sufficient to affect the size of the group, provided the ground is firm or a T-base is used.

(iii) The gun will be half loaded and laid so that the shots will strike the screen. The traversing clamp will then be tightened. No aiming mark is required.

(iv) The trigger bar will be withdrawn and retained in this position by means of a device fixed to the firing lever.

(v) The loading will now be completed and this will cause the gun to fire automatically until the 10 rounds are fired.

(vi) The group will then be measured. If the gun fails to group in a 3 in. ring, the cause is generally attributable to the mounting. Steps must be taken to analyse the cause or causes of the failure to group, which must be eliminated before Part I is fired.

PRINTED IN FRANCE

PART I.

7. Part I is instructional, and is carried out on the 25 yards range. As the machine gunner will have hitherto carried out little firing with service ammunition, careful and thorough instruction is necessary throughout. For this reason no time limit is placed upon any of the practices, and in order that the beginner may assimilate the lessons to be learnt all the practices of Part I should not be fired on one day. Each practice will be explained to each man before he fires. The best value will be obtained by criticising each practice while it is in progress, ceasing fire for the purpose, rather than by waiting until the practice has finished before commencing to criticise. At the conclusion of the practice faults should also be pointed out at the target, and the firer told how to correct them.

8. The instructor at the firing point should watch the firer, *not* the target, in order that he may see that all points of elementary training are carried out correctly. The shots on the target will bear witness to any faults that the firer may have committed whilst firing. Instructors must realize that the greatest care must be taken to eradicate such faults during the firing of Part I, so that the gunner shall not carry them with him, and acquire faulty actions from the commencement of his training. This applies equally to the actions of the No. 2 at the gun. The following are the points to which particular attention must be paid :—

In No. 1 :—

Correct firing position and holding.

Quick and clear repetition of all orders.

Quick and accurate loading and laying.

Correct pressure on the thumbpiece on the signal "Fire."

Eyes on the target, not looking along the sights or down at the thumbpiece when firing.

Attention to "Points during firing."

In No. 2 :—

Inspection of ammunition and belts.

Correct service position (not kneeling up).

Attention given to control signals and to feeding the gun, not watching the target.

Correct and rapid transmission of signs to "Fire" and "Cease fire."

9. As the accuracy of the first shot of each group fired by a machine gun is not reliable, one wide shot will generally be found when examining a group, and this should be borne in mind by instructors when criticising the results of a practice or when measuring the size of a group. If the point of mean impact of a group does not strike the target $\frac{5}{8}$ inch to the right of the point of aim, the foresight must be adjusted.

10. Practices of Part I may be repeated as considered necessary by the company commander, provided that the total number of rounds allotted to Parts I and III is not exceeded. No record of results need be kept, but only the total number of rounds expended by the company in Part I.

PART II.

11. Before proceeding to fire practices 8 to 17, the machine gunner will be exercised in observation of fire on a field firing range (Practice 7). The practice will be limited to the observation of fire of one gun during this period of individual training. It is essential that the machine gunner should appreciate the varying conditions under which observation of fire may be possible, and for this purpose the range and the area selected for the beaten zone should be varied for the different numbers of the gun detachment. Further, as detachments will benefit from observing fire under varying conditions of weather and light, it is advisable to allot several days for the conduct of this practice so that one detachment may receive further training when other detachments are being exercised.

Practices 8 to 17, Part II, are fired on the Classification Range, and a strict time limit is imposed in the Classification Practices. In these, the firer is classified as either a—

Marksman gunner,

1st Class gunner, or

Qualified gunner,

according to the scores he obtains. The firer should have learnt by this time how to handle his gun, and consequently no help or criticism will be given while he is actually firing. He should be left to his own resources, with the object of developing self-reliance and confidence in himself and his weapon. The strictest possible discipline must be enforced at the firing point, and, as in Part I, all points of elementary training should be carried out correctly. In range work, there is an inevitable tendency for these to be neglected, which can only be checked by the vigilance and care of section officers and instructors.

PRINTED IN FRANCE BY

12. Each practice and the time allowed will be explained clearly to each man before he fires. After the No. 1 has reported "Gun Clear," the Nos. 1 and 2 will remain standing beside the gun, and any necessary criticism will be made by the instructor. The instructor will then dismiss the No. 1 from the firing point, and will call up the next number and remind the firer of the object of the practice.

13. In the Classification Practices (9, 10, 12, 13 and 14), fire will be stopped as soon as the time limit is reached. No allowance will be made in these practices for stoppages which are due to causes other than defects of the mechanism or breakages. The firer will be given time to look over the gun and ammunition belt before each practice is begun.

NOTE.—Should the stoppage be due to a defect in the mechanism, or to a breakage, sufficient time to remedy such stoppage will be allowed, or the practice may be repeated.

14. Points will be allotted in the Classification Practices as follows :—

PRACTICE 9—

For each hit on the target below and including 15 :	2 points.
" " above 15 :	3 points.

PRACTICE 10—

For each hit on the target :		1 point.
No spaces missed :	add	30 points.
One space missed :	add	25 points.
Two spaces missed :	add	20 points, and so on.
Six or more missed :	add	0.

PRACTICE 12—

For each hit on the target below and including 10 :	4 points.
" " above 10 :	5 points.

PRACTICE 13—

For each hit on the target :		1 point.
No spaces missed :	add	50 points.
One space missed :	add	45 points.
Two spaces missed :	add	40 points, and so on.
Ten or more missed :	add	0.

PRACTICE 14—

For the first hit on the target :	30 points.
or each subsequent hit on the target :	5 points.

In Practices 10 and 12, the screens should be divided into rectangles by means of vertical lines, invisible to the firer, 20 inches apart. A space means any rectangle which does not contain a bullet mark. A hit on a dividing line to count as most favourable to the firer, but will only count in one rectangle.

In order to be classified as a—

Marksman gunner, 250 points must be obtained.
1st Class gunner, 200 points must be obtained.
Qualified gunner, 150 points must be obtained.

Those who obtain less than 150 points will be put back for further instruction.

Careful record of the number of points obtained by each firer in each practice will be kept : also of the number of rounds fired.

PART III.

15. The ammunition allotted to this part will be at the disposal of the platoon or company commander according to the organization in force, and may be expended as he considers most beneficial for the efficiency of his platoon or company. This will, however, include :—

(*a*) Practice in observation of fire for officers, warrant officers and those non-commissioned officers who may be called upon to control the fire of a tactical unit.
(*b*) Application of fire as the result of observation and when observation has not been obtained.

Whenever possible, practice should be given in firing at ranges of 1,000 yards and over. No record of these rounds other than the entry in the ammunition book, except such as are expended for extra practice of bad shots, need be kept, nor should any statement of the method of expenditure be required.

PART IV.

16. *Field practices.*—These exercises should be carried out between ranges of 600 and 1,200 yards. The training of a machine gun platoon or company cannot be considered complete until it has fired field practices on a field firing range.

PRINTED IN

Allotment of Ammunition.

PART I.

	Rounds.
Each officer, N.C.O. and man...	260

PART II.

Each officer, N.C.O. and man...	590

PART III.

*Each officer, N.C.O. and man...	80

PART IV.

*Each officer, N.C.O. and man...	100

PART V.

*Each officer, N.C.O. and man	70

* These rounds will not be fired individually, but will be expended collectively during field practices.

SUMMARY OF PRACTICES: PARTS I, II, III, IV AND V.

No.	Nature of Practice.	Rounds per man.	Total rounds per man.
	PART I.		
1	Grouping	20	—
2	Single shot traversing	20	—
3	Single shot searching	12	—
4	Oblique traverse	100	—
5	Application	40	—
6	Stoppages	30	—
	Total for Practices, Part I	222	—
	For testing mounting and gun, and repetition ...	38	—
	Total for Part I		260
	PART II.		
7	Observation (up to 1,000 yards) ...	90	—
8	Ranging (400x)	20	—
*9	Application (400x)	30	—
*10	Traversing (400x)	70	—
11	Ranging (600x)	30	—
*12	Application (600x)	30	—
*13	Traversing (600x)	100	—
*14	Service application (600x)	50	—
15	Oblique traverse (600x)	70	—
16	Ranging (800x)	30	—
17	Application (800x)	70	—
	Total for Part II		590
	Total, Parts I and II		850
	PART III.		
	Fire at long ranges, demonstrations and tests ...	80	80
	PART IV.		
	Field practices	100	100
	PART V.		
	Tactical exercises	70	70
	Total for Parts I, II, III, IV and V		1,100

* Classification Practices.

PRINTED IN FRANCE BY

SECTION 40.—DETAIL OF PARTS I AND II.

PART I.—INSTRUCTIONAL.

To be fired at 25 yards range. Target: Instructional Machine-gun Target. (See Plate XXV, 1, 2, 3 and 4.)

No.	Nature of Practice.	Target.	Rounds.	Object of Practice and Method of Conducting.
1	Grouping	Plate XXV, Fig. 2	20	To find the sighting elevation necessary to hit the point of aim. (*See* Section 53 (9)). Fired in two spaced groups of 10 rounds each, directed on two different aiming marks.
2	Single shot traversing ...	Plate XXV, Fig. 2	20	To practice automatic tapping fired in two traverses of 10 single shots each, one to the right and one to the left.*
3	Single shot searching ...	Plate XXV, Fig. 2	12	To practice automatic turning of the elevating wheel. Fired in two searches of six single shots each, one up and one down.*
4	Oblique traverse ...	Plate XXV, Fig. 2	100	To combine automatic tapping with quick relaying and control of the burst of fire. Fired in seven bursts of 12-15 rounds each at the seven aiming marks respectively.
5	Application ...	Plate XXV, Fig. 4	40	To teach quick application and the control of the burst of fire. Fired in four bursts of fire of about 10 rounds to each. The instructor indicates the two columns M and N. The firer then fires at M, and, without further orders, immediately reloads, relays and fires at N. After criticism, the procedure is repeated, columns P and Q being indicated.
6	Stoppages ...	Any	30	To practice rectification of stoppages with ball ammunition Using 30 rounds of S.A.A., belts are prepared beforehand with six stoppages per firer, viz.: separated case, missfire, bad fault in feed, thick rim (specially made), two successive missfires. Any form of aiming mark may be employed that will enable the accuracy of the firer's relaying to be checked.
		Total rounds ...	222	
		Repetition ...	38	
	Total	for Part I ...	260	per man.

* Practices 2 and 3 will be fired concurrently, *i.e.*, one traverse, one search going completely round the target. The firer must observe his target and not use his tangent sight (which, however, will remain raised), except for the initial laying at the commencement of each practice.

range-takers and instruments."

Part II.—CLASSIFICATION.

No.	Nature of Practice.	Nature of Target.	Range Yards.	Rounds.	Time Secs.	Remarks.
7	Observation ...	—	Up to 1,000	90	—	
8	Ranging	—	400	20	—	Fixed sights. Ranging fire should be carried out against a bank of earth adjacent to the target, if possible. In this practice each man has the opportunity of sighting his gun on the open range before the classification practice
9	Application ...	Screen 6 ft. square. (*See* Plate XXV, 3)	400	30	10	Fixed sights. Only shots within the 5-ft. square count.
10	Traversing	Screen 3 ft. high, 20 ft. long	400	70	30	Fixed sights. Gun to be traversed by groups from right to left: the firer is required to traverse the target with the rounds allotted within the time limit, without restrictions as to traversing backwards.
11	Ranging	—	600	30	—	*See* Practice 8. Tangent sight used.
12	Application ...	Screen 6 ft. square. (*See* Plate XXV, 3)	600	30	15	Tangent sight used. All shots on the screen count.
13	Traversing	Screen 3 ft. high, 30 ft. long	600	100	45	Gun to be traversed from left to right; tangent sight used. Other conditions are the same as for Practice 10.
14	Service application...	Equilateral triangle of 4 ft. 6 in. sides, mounted on pole. (*See* Plate XXV, 3)	600	50	30	The gun is loaded, and the firer is given the range. He is pointed out limits between which his target will appear; these limits should be about 30 yards apart. The triangular target is hoisted at any spot and *at any height* between these limits on signal from the firing point. Exposure 30 seconds, after which the target disappears. Timing is done in the butts. The firer lays and fires immediately the target appears, and observes his fire. This practice exercises the firer in quick laying and application on to a difficult target, which suddenly appears at any spot.
15	Oblique traverse ...	20 falling iron plates arranged diagonally on on a frontage of 36 ft. in two rows, at an angle of 90 degrees to each other.	600	70	60	The firer lays on the left or right bottom edge of the row of plates, and traverses up and down the rows. Fire should be in bursts of about 14 rounds each. Fire from the prone position. If iron plates cannot be obtained, two 3 ft. by 10 ft. screens should be placed diagonally up the butts.
16	Ranging	—	*800	30	—	*See* Practice 8. Tangent sight used.
17	Application ...	As for 9	*800	70	20	Tangent sight used. All shots on the screen count.

* Where 800 yards range is not obtainable, these practices may be carried out on a field firing range, or the ammunition may be utilized for further training in practices of Part II at the discretion of the Battalion Commander.

range-takers and instruments."

Section 41.—Examples of field practices.

Example No. 1.

Object.—To bring out the necessity of :

(1) Quick reconnaissance.
(2) Selection of position.
(3) Rapidity of coming into action from limber.
(4) Fire orders.

Targets.—Representing a strong patrol (50 Figures).
Distance.—650.
Rounds.—1 belt per gun.
Situation.—A flank guard covering the ——— flank of a force marching from ——— to ———, is moving *via* ——— and ———.

Composition of flank guard—

2 companies infantry.
1 section machine gun company.

On arrival of the main guard (of the flank guard) at ———, a scout comes in from the ——— flank with the information that a strong patrol of the enemy has appeared at ———.

The O.C. flank guard orders the section of machine guns to deal with the situation, and the infantry continues its march.

(Instruction for Butt Officer, 50 targets to be raised from ——— when ordered).

Points to Criticise—

(1) Time taken to reconnoitre.
(2) Time taken to open fire.
(3) Method of approach.
(4) Position selected.
(5) Fire orders.
(6) Action of the detachment.

Example No. 2.

Object.—To teach the correct use of ground, and to show the necessity of engaging unsuitable targets to help the infantry in gaining fire superiority with a view to advancing.

Rounds.—250 rounds per gun.

Targets.—12 head and shoulders targets to represent enemy snipers concealed in undergrowth : 1 machine gun figure target (Plate 3) in action holding up the advance of our infantry.

Distance.—Unknown, 300 to 500 yards.

Situation.—The O.C. advanced guard, seeing his vanguard company held up and unable to push on, sends a machine gun subsection to support it. The O.C. vanguard points out the approximate location of enemy machine gun and snipers.

Composition of vanguard—
2 companies of infantry.

Points to criticise—

(1) Method of advance and use of ground.
(2) Reconnaissance of position selected.
(3) Getting into action with minimum exposure (concealment more important than time).
(4) Method of engaging enemy and control of fire.
(5) Arrangements for observation of fire.
(6) Use of fixed sight.

Example No. 3.

Object.—To exercise a section officer who is in a defensive position in handling his section against a determined opponent ; and to exercise the N.C.O.s and men of the section in carrying out all orders issued.

Targets—

20 (Figure 3).
6 („ 6).
20 („ 3 on poles).

Distance.—600, about.
Rounds.—1 belt per gun (4 guns).
Situation.—A section has been placed on a commanding position on the ——— flank of a force to prevent any enveloping movement which the enemy is expeeted seriously to attempt.

20 Figure 3 targets placed (in an irregular manner to represent the method of dribbling up reinforcements) to the left or right rear of the stop butt.

6 Figure 6 targets to move along the gallery.

20 Figure 3 targets to be exposed at the far end of the gallery to represent the firing line being built up.

The first group of Figure 3 targets must necessarily be put out before the exercise begins. Therefore the section officer, as soon as he has taken up his position and made his preliminary arrangements, will be told that these targets represent hostile reinforcements being "dribbled" up, and that any moving targets which may appear are in the scheme.

PRINTED IN FRANCE BY ARMY PRINTING

(Instructions will be given to the Butt Officer with reference to the exposure of the 6 Figure 6 and the other 20 Figure 3 targets).

Points to criticise—

(1) Action and position of the various gun numbers.
(2) Number of guns employed.
(3) Position occupied.
(4) Action of range-taker.
(5) Arrangements for prolonged action.
(6) Fire orders and methods of fire.
(7) Fire orders for fresh targets.

Example No. 4.

Object.—To bring out the necessity of :—

(1) Quick reconnaissance.
(2) Quick decision and prompt action.
(3) Rapidity of coming into action from limbers.

Targets.—10 screens with Figure 2 targets against them (representing a body of infantry on the march).

Distance.—Unknown.

Rounds.—100 or 250 per gun.

Situation.—A flank guard, covering the ———— flank of a force marching from ———— to ————. is moving *via* ———— and ————.

Composition of Flank Guard—

2 companies infantry.
1 section machine gun company.

On the arrival of the main guard (of the flank guard) at ———— a scout reports that a body of hostile infantry in close order about ——— yards distant is marching in the direction of ————.

The machine gun section is at once ordered to deal with the situation.

Points to criticise—

(1) Time taken to reconnoitre.
(2) Time taken to open fire.
(3) Method of obtaining the range.
(4) Gun positions selected.
(5) Simultaneous opening of fire.
(6) Action of detachment.
(7) Fire orders.

Example No. 5.

Object.—To test the ability of a section officer in switching the fire of his guns from one target to another.

Targets.—Six 10-foot screens, 50 yards in front of gallery, with 18 Figure 2 targets showing over the top of them, representing hostile troops firing over a parapet.
20 Figure 3 targets on poles in the gallery, representing supports.

Distance.—450 yards.

Rounds.—150 per gun.

Situation.—Enemy are supposed to have opened rapid fire on one of our working parties which they have located behind our front line trenches. The section officer at once opens fire on to hostile trenches.
10 seconds after fire is opened supports show themselves in a trench in rear to the flank of the hostile front trench.
The 20 Figure 3 targets appear in the gallery and will be lowered as, and when hit.

Points to criticise—

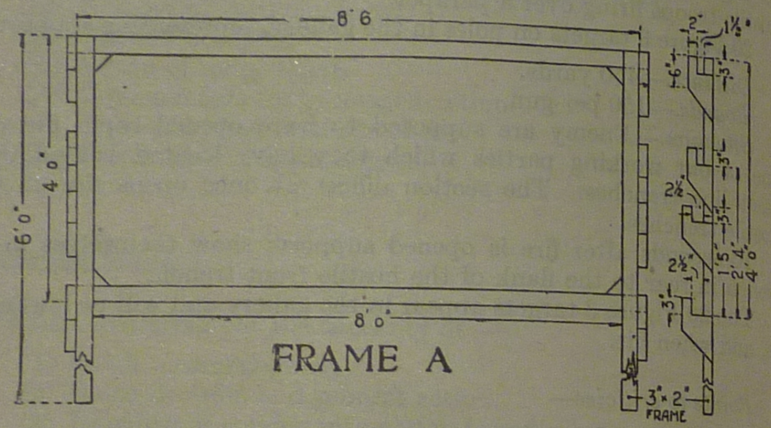
(1) Original fire orders.
(2) Fire discipline for the change of target.
(3) Fire orders for new target.
(4) Time taken to bring fire to bear on new target.
(5) Effect obtained.
(6) Whether original target was abandoned.
(7) How the Nos. 1 observed their fire.

PRINTED IN FRANCE BY ARM

SECTION 42.—DESCRIPTION OF TARGETS.
PART I.

Target frame.—The frame required for mounting the targets is shown in Plate XXV, Fig. 1.

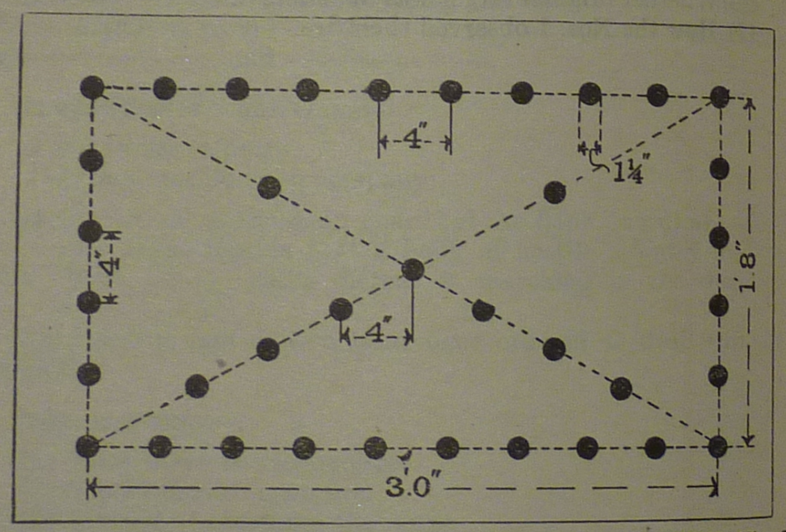
PLATE XXV—MACHINE GUN COURSE TARGETS.—Fig. 1.



On this frame two targets are set up (*see* Fig. 3).

Practices 1, 2, 3 and 4 are fired on the left target and Practice 5 on the right target. Dimensions are given in Plate XXV, Fig. 2.

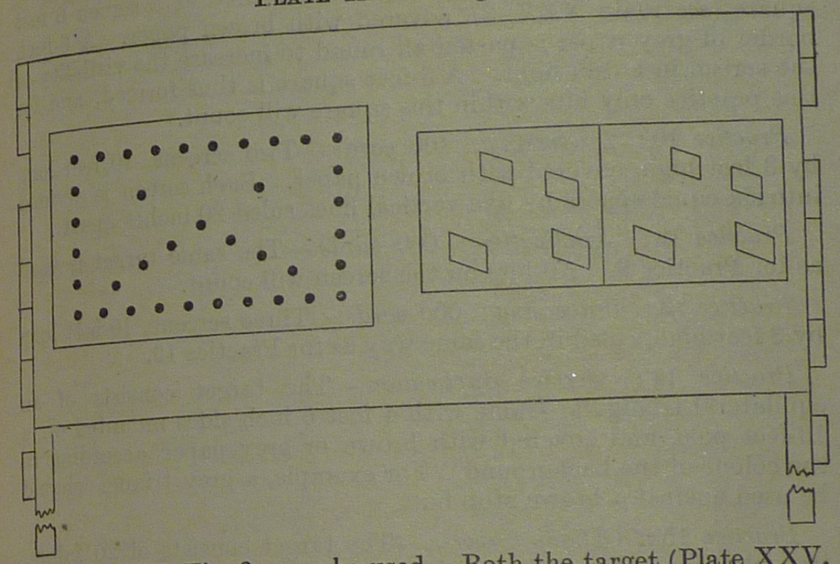
PLATE XXV.—Fig. 2.



The target for practices 1, 2, 3 and 4 (*see* Plate XXV, Fig. 2) consists of a number of bullseyes 1¼ inches in diameter. These bullseyes are put on the target frame by means of a stencil which will be prepared locally.

The target for Practice 5 is as shown in Plate XXV, Fig. 4, or an outline of the area occupied by four groups of figures as indicated

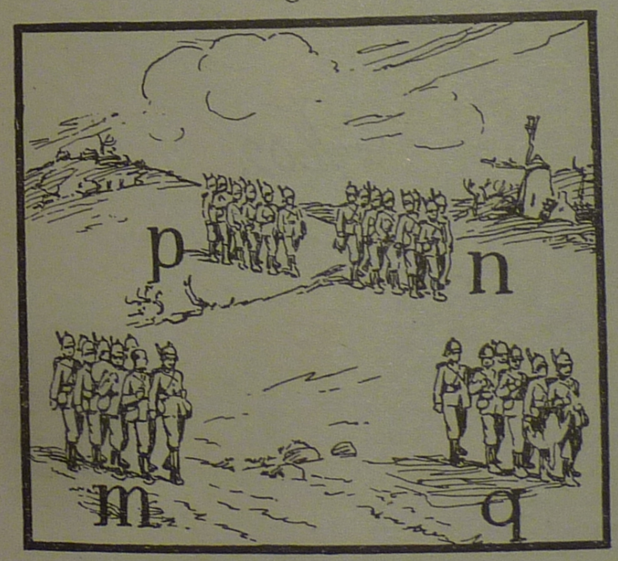
PLATE XXV.—Fig. 3.



in Plate XXV, Fig. 2, may be used. Both the target (Plate XXV, Fig. 4) and the outline are articles of store and any two can be placed on the right half of frame "A."

ENLARGED VIEW OF THE APPLICATION TARGET FOR PRACTICE 5.

Fig. 4.



PRINTED IN FRANCE BY ARMY PRINTING

114

PART II.

Practice 9: *Application*: 400 *yards*.—Is fired at a screen 6 feet square (*see* Plate XXV, 3), covered with brown paper. A 6-inch border of grey paper is pasted all round to increase the visibility of the screen in a dull light. A 5-feet square is thus formed, and for this practice only hits within this square will count.

Practice 10: *Traversing*: 400 *yards*.—Two screens, 10 feet long by 3 feet high, covered with brown paper. Each screen is divided into six equal spaces by five vertical lines ruled 20 inches apart.

Practice 12: *Application*: 600 *yards*.—The same target is used as for Practice 9. All hits on the screen will count.

Practice 13: *Traversing*: 600 *yards*.—Three screens, 10 feet long by 3 feet high, ruled in the same way as for Practice 10.

Practice 14: *Service application*.—The target consists of an equilateral triangular frame with 4 feet 6 inch sides mounted on a 10-feet pole, and covered with brown or grey paper according to the colour of the background. For example, a grey triangle should be used against a brown stop butt.

Practice 15: *Oblique traverse*.—The target consists of 20 falling iron plates, arranged diagonally on the stop butt in two rows, on frontage of 36 feet, at an angle of 90 degrees to each other.

Practice 17: *Application*: 800 *yards*.—The same target is used as in Practice 9. All hits on the screen will count.

-/602

T.9.

ISSUED DOWN TO DIVISIONS
(for distribution down to Battalions and Machine Gun Companies).

NOTES ON RECENT FIGHTING No. 22.

(ISSUED BY THE GENERAL STAFF.)

MACHINE GUN TRANSPORT IN THE ATTACK.

The following notes are based upon experience gained during the offensive operations now in progress:—

(i) Resort should only be made to man handling when all other means of transport have been found impossible.

(ii) The employment of pack transport throws a considerable strain on men and animals, both in the matter of casualties and fatigue. Pack animals are difficult to manage under fire and are often stopped by wire and trenches. If more than sixteen animals in a company are employed for pack, a proportion of the limbers are immobilized. Pack transport, therefore, should not be used unless it is impossible for limbers to reach the required destination.

(iii) If a route can be reconnoitred, or selected after a careful study of the map and aeroplane photographs, and if sufficient latitude can be given as to the line of advance, wheeled transport is usually able to reach its destination.

(iv) If the ground is likely to be difficult for transport, it is advisable to use half limbers, either (*a*) with a full team, or (*b*) with the leaders carrying the guns and tripod on pack. Half limbers can be taken over almost any ground which is passable for pack animals, and will afford a smaller target.

(v) An arrangement which has proved satisfactory is the attachment of a pack mule to each gun team, the mule remaining with the team, carrying the gun and tripod, and going back for rations and S.A.A. at night.

(vi) When crossing exposed ground, wheeled transport should gallop for the next cover, the gun teams working their way to it independently.

(vii) When in action, the limber can be left under cover close up to the gun, while the animals are taken back to a safe distance. The limber will then serve as the S.A.A. dump and, if a change of position is ordered, can be loaded ready to move off as soon as the animals are brought up.

(viii) The general practice with regard to the supply of ammunition has been to withdraw two S.A.A. limbers from each company into battalion reserve. The two remaining limbers form the company reserve. As each company limber is emptied, it is returned and filled up from the D.A.C., being replaced by a full limber from battalion reserve.

(ix) Both aeroplanes and tanks have given great assistance in the supply of ammunition. Tanks have frequently delivered supplies of belt boxes to the most advanced machine guns, and considerable amounts of S.A.A. have been dropped by aeroplanes when the V shaped ground signal has been laid out

6th of October, 1918.

PRINTED IN FRANCE BY ARMY PRINTING AND STATIONERY SERVICES. PRESS A—10/18—4,500.

259

S.S. 192.]

[O.B. 1482A.
40/W.O./5678.

THE EMPLOYMENT OF MACHINE GUNS.

PART II.

ORGANIZATION AND DIRECTION OF FIRE.

(Issued by the General Staff.)

January, 1918.

(3889) [3·18] Wt. w. 1845—PP 1644 10M 5/18 H & S P 18/187

THE EMPLOYMENT OF MACHINE GUNS.

PART II.

Organization and Direction of Fire.

CHAPTER I.

Section.		Page.
1.	Machine Gunners' Mathematics	5–8

CHAPTER II.

Map Work.

2.	Maps...	9–16
3.	Scales	16–17
4.	Contours	18–21

CHAPTER III.

Fire Direction.

5.	Theory of Fire	22–31
6.	Combined Sights, Searching and Traversing ...	31–40
7.	Direct Overhead Fire	40–5
8.	Indirect Fire (general)	45–7
9.	Indirect Fire of Guns Controlled Singly	48–59
10.	Indirect Fire of Guns Controlled in Batteries] ...	59–76
11.	Maintaining Laying	77
12.	Safety Clearances	77–84
13.	Night Firing	84–6
14.	Searching Reverse Slopes	86–9
15.	Errors	89
16.	Modifications in Equipment	89–91
17.	Machine Gun Barrage Fire	91–102
18.	Communications	103

NOTE.—The paragraphs marked in the text with an asterisk may be omitted on a first reading.

APPENDICES.

		Page.
I.	Order Board	104-5
II.	Types of Machine Gun Emplacements	106-8
III.	Communications :—	
	(*a*) Offensive Operations	109
	(*b*) Trench Warfare	110
IV.	Tables :—	
	No. 1—Tangent Elevation	111
	No. 2 (A)—Trajectory Table	112
	No. 2 (B)—Trajectory Table	113
	No. 3 (A)—Quadrant Elevation	114
	No. 3 (B)—Quadrant Elevation	115
	No. 4—Atmospheric Allowances	116
	No. 5—Wind Allowances	117
	No. 6—Time of Flight	117
	No. 7—Searching Reverse Slopes	118
V.	Graphs :—	
	No. 1—Quadrant Elevation and Clearances } Facing p. 118	
	No. 2—Traverses ... ... }	
VI.	Fire Sheets :—	
	No. 1—Indirect Overhead Fire Sheet ...	119
	No. 2—Battery Chart	120
	No. 3—Gun Chart	121
VII.	Fighting Maps :—	
	No. 1—Group Commander's ... ... } Facing p. 123	
	No. 2—Battery Commander's ... ... }	
VIII.	Compass Tower	123-4
IX.	T. Bases	125-6
X.	Aiming Marks	127-132
XI.	Adjustment of the Mark V. Clinometer	133
XII.	Care of Machine Guns in Frosty Weather ...	134

PART I. deals with "The Tactical Employment of Machine Guns."

INDEX.

A.

	Page.
Aiming Mark, Night	85, 90
Aiming Post, Maintaining Laying by	77
T. (also App. X.)	57, 90
Zero	59
Angle of distribution and concentration (*see* "Distribution" and "Concentration").	
Angle of Switch	60, 61
Angle of Deviation	69
Artillery, Co-operation with, general	40, 92

B.

Bar Foresight		57, 89
Barrage. Object of		93
Fire		92
Drill		96–100
Flexibility		96
Barrage Guns, Organization of		94
Barrels, Life of		102
old *versus* new		31
Battery Commander, Duties of		5
System in attack (*see* Sec. 10).		
Belt-filling		102
Bullet, Penetration at long ranges		31

C.

Climatic Influences (also App. IV. No. 4)		27, 31
Clinometer (also App. XI.)		58, 78, 89
Combined Sights, Method of		33–4
for engaging deep target		34–7
for oblique traversing		39–40
Communications (also App. III.)		103
Compass (*see* also "Maps").		
Deviation from Grid		10–12
Direction by		50–6
Direction by, Experiments with		46–7
Parallel lines by		71
Tower		Appendix VIII.
Concentration of Battery fire. General		45
Method of		65–70
Contours		18–21

D.

	Page.
Danger Zone	86
Definitions	22–5
Dial Direction, Rotatable	91
in Resection	15
Direction, Obtaining	51–6
Maintaining	77
Director, Parallel Lines by	71
Distribution of Battery Fire, General	45
Method of	60–64

E.

Electric Torch	85
Elevation, Obtaining	57–8
Maintaining	77
Equipment, Modification in	88
"Equivalent Range"...	79

F.

Field Survey Company	16, 51
Fire Direction...	22 *et seq.*
Fighting Map (Appendix VII.)	
Flash Obscurer	85

G.

Gradient (*see* Slope)	19
Graticules	42–3, 48
Group Commander, Duties of	94–5

H.

Harassing Fire, Targets for	92, 102

I.

Indirect Fire (Sec. 8 *et seq.*)	

M.

Map and Compass, Direction by	51–8
,, ,, R.O. ,, ,, ...	55–6
,, ,, ,, and Compass	56–7
Meridian	9

N.

Night Firing	84–6
Lamp	85
North True and Magnetic	9
Grid	10, 51

O.

Obstruction, clearing	82

P.

	Page.
Parallel Lines, Mathematics of	6–7
Method of obtaining	70–5
"Permissible Error"	31–3
Petrol Tins	91
Photographs, Air	21
Probable errors in range finding	32–3
in direction and elevation in indirect fire	46, 89
Protractor, Use of	13–14
Special in shape of sector of circle	91

R.

Rates of Fire	101
Reference Objects, direction by, experiments with ...	46, 55
parallel lines by	72–5
Representative fraction	16
Resection, ground to map, compass	13
range Finding instrument ...	14
super position	15
map to ground	15–16

S.

Safety Angles	40–1
Clearances	77
how found	80
devices	89–90
Scales	16
Searching	34–8
reverse slopes	86–9
Section, Plotting of	20–1
Shutter, Fire Control by	60
Slopes, General	19
Fire effect in relation to	25–7
Searching reverse	86–9
Smoke, absence of, necessary for direct overhead ...	45
S.O.S. Line, Zero Line on left end of	59
Stops, depression and traversing	77, 85

T.

"T"-aiming posts (also App. X.)	57, 90
Tangent Sight, Method of direct overhead	43–4
"T"-bases (also App. IX.)	78
TOG Method	49–50
Training, Points for programme	89
Trajectory Tables (also App. IV.), how compiled ...	84
Traversing	38–40
in battery fire	59–60
Trench Slits Diagram (App. II.)	
Triangle of Error method	77
obtained in Resection	14

V.

V.I. (Vertical Interval)
Use of formula ... ... Pages 15
Proof of formula 57–8, 81–2
Visibility, Mutual 7
... 13–20

W.

Whistle, Fire Control by 91
Wind Allowances (also App. IV. No. 5.) 93–95

Z.

Zero line and Aiming Posts 81

NOTE.—The terms "Machine Gun," "Barrage," and "Battery" are used throughout this publication in the following senses:—

Machine Gun, to denote the ·303 Vickers Machine Gun.

Barrage fire by Machine Guns is the fire of a large number of guns acting under a centralized control directed on to definite lines or areas in which the frontage engaged by a gun approximates 40 yards. (*See* Sec. II. paras. 1.)

Battery:—A battery of machine guns only exists as a tactical unit in the motor machine gun branch of the Machine Gun Corps. In the Cavalry and Infantry branches the word is merely used as being the most convenient term for denoting a suitable number of guns placed under an officer as a fire unit for a particular purpose. (*See* Part I., Sec. 5.)

PART II.—ORGANIZATION AND DIRECTION OF FIRE.

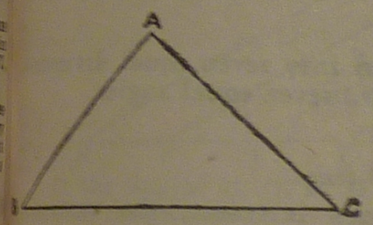
CHAPTER I.

1.—MACHINE GUNNERS' MATHEMATICS.

A knowledge of the following simple mathematical facts is of great assistance in modern machine gunnery.

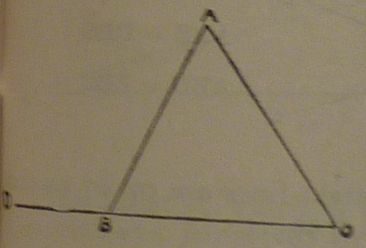
1. *Triangles.*

(i.) The three angles of a triangle are together equal to two right angles. Thus, if any two angles are known, the remaining angle can be found.



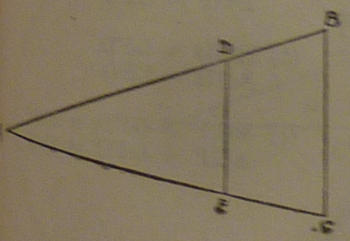
ABC + BCA + CAB = 2 right angles = 180°

(ii.) The exterior angle of a triangle is equal to the two interior and opposite angles.



DBA = BAC + BCA

(iii.) If a line is drawn parallel to one side of a triangle, it divides the other side into proportional parts.

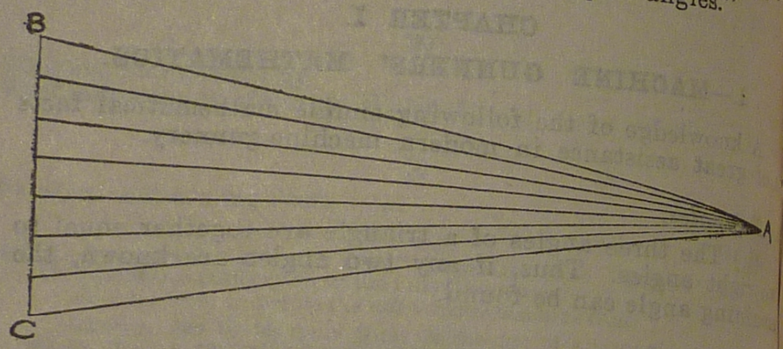


DE is parallel to BC

Then $\frac{AE}{AC} = \frac{AD}{AB} = \frac{DE}{BC}$

Sec. 1.

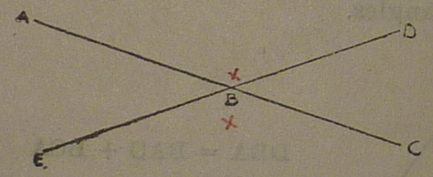
(iv.) *When the apex angle of a triangle is small*, the following is true for all practical purposes:—"If the base of a triangle be divided into a number of equal divisions and these divisions be joined to the apex, then the apex angle will be divided into the same number of equal angles."



Example:—If BC be divided into seven equal divisions, the angle BAC is also divided into seven equal angles.

2. *Angles and parallel straight lines.*

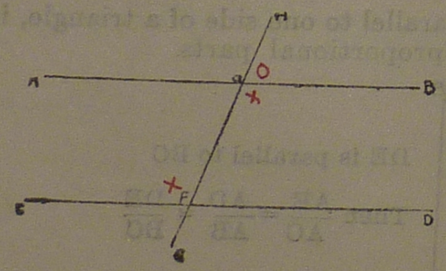
(i.) When two straight lines intersect, the vertically opposite angles are equal.



ABE = DBC

ABD = EBC

(ii.) When two parallel straight lines are cut by another straight line, the following are true:—

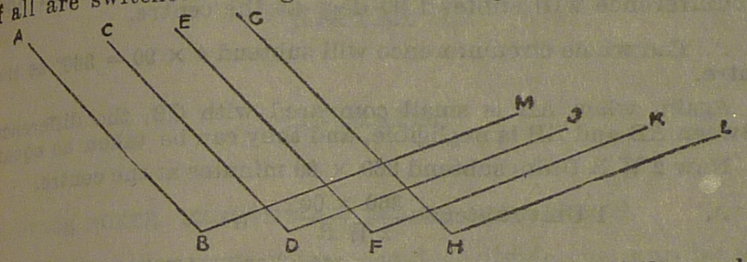


(*a*) AGF = GFD
BGF = GFC

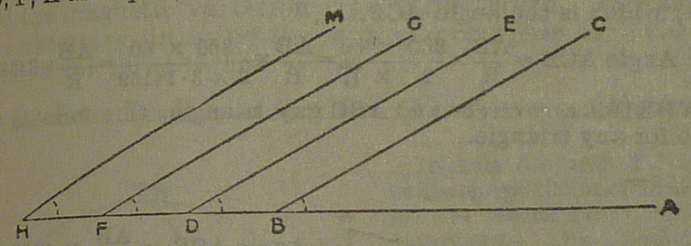
(*b*) HGB = GFD
AGH = CFG

(*c*) BGF + GFD = 180°
AGF + GFC = 180°

(iii.) If straight lines are parallel, they will still be parallel if all are switched through the same angle.

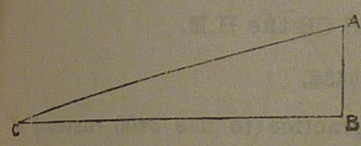


If the lines AB, CD, EF, GH are parallel, then if the angles B, D, F, H are equal, the lines BM, DJ, FK and HL will be parallel.



If the angles B, D, F, H are equal, then the lines BC, DE, FG, HM, are parallel.

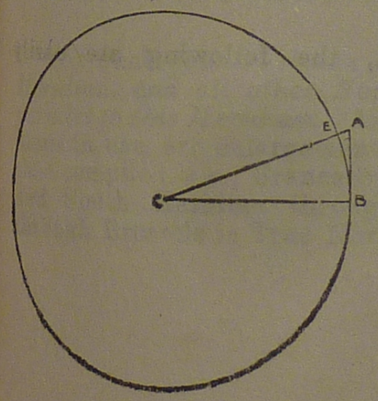
*3. *The "V.I. over H.E." Formula.*



Let AB = V.I. (Vertical Interval).
Let BC = H.E. (Horizontal Equivalent).
Let angle ABC = 90°
Then provided AB is small in comparison with BC, the angle ACB (in minutes)

$$= \frac{\text{V.I.}}{\text{H.E.}} \times 3400.$$

This formula, which is the basis of almost all Machine Gun problems, is derived as follows:—



If the circumference of any circle be divided by the diameter, the same result is always obtained; the circumference being 3·14159 times the diameter.

This figure 3·14159 is always denoted by π.

$\therefore$ Circumference = $\pi \times$ diameter.

$= \pi \times 2R$

where R is the radius.

Sec. 1.

Also the curved line BE is said to "subtend" the angle ECB at the centre. It is clear that a quarter of the circumference will subtend 90 deg. at the centre.

∴ The whole circumference will subtend $4 \times 90 = 360°$ at the centre.

Again, when AB is small compared with CB, the difference between AB and EB is negligible, and they can be taken as equal.

Now 2 ∏ R Units subtend 360 × 60 minutes at the centre.

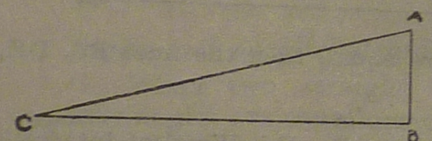
∴ 1 Unit subtends $\frac{360 \times 60}{2 \prod R}$ " " "

∴ AB (*i.e.* BE) units subtend $\frac{360 \times 60 \times AB}{2 \prod R}$ minutes at the centre; which is the angle ACB.

∴ Angle $ACB = \frac{AB}{R} \times \frac{360 \times 60}{2 \times \prod} = \frac{AB}{R} \times \frac{360 \times 60}{2 \times 3{\cdot}14159} = \frac{AB}{R} \times 3438.$

As BED is any circle and ABC any triangle, this formula will be true for any triangle.

Thus—



Angle $ACB = \frac{AB}{CB} \times 3438$ (in minutes).

Now AB represents the V.I., and CB the H.E.

∴ Angle in minutes $= \frac{V.I.}{H.E.} \times 3438.$

It will be more convenient in practice to use 3400 instead of 3438 and thus we get:—

Angle in minutes $= \frac{V.I.}{H.E.} \times 3400.$

The error introduced is 38 in 3438; *i.e.*, 1 per cent. approximately.

From the above formula, the following are easily obtained:—

$$V.I. = \frac{Angle \times H.E.}{3400}$$

$$H.E. = \frac{V.I. \times 3400}{Angle}$$

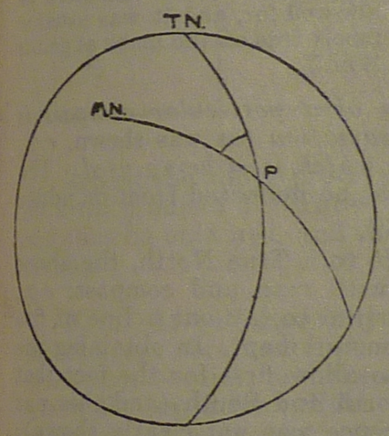
CHAPTER II.

2.—MAPS.

1.—TRUE NORTH, MAGNETIC NORTH, AND GRID NORTH.

On the older maps it was usual to divide the map by grid lines into squares, and to shew in the margin the True North and the magnetic variation from True North. It was therefore necessary, in using the map and compass for field work, to allow for three things:—

(a) *True North and Magnetic North are not the same.*

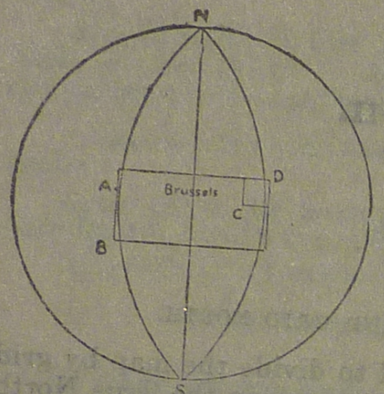


In this diagram T.N. represents the position of True North (at the North Pole), and M.N. represents the position of Magnetic North (a point at present in the northern extremity of North America).

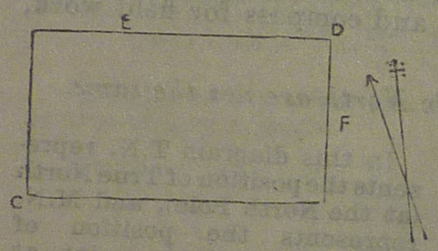
If any point P is taken on the Globe, True North will be in the direction of T.N. and Magnetic North will be in the direction of M.N.

The angle TPM is the magnetic variation for the point P, and not only does this angle vary for different points, but it also varies year by year for any particular point.

(b) *Each country bases all its maps on one particular Meridian, and all other North and South lines are drawn parallel to this Meridian.* All other maps, such as the Trench Maps in use, are enlargements of portions of an original map thus compiled, *e.g.*, France bases its maps on the True North and South Meridian through Brussels, and the grid line through Brussels is True North and South.



But if any other point A is taken, the line AB, though parallel to NS, is not True North and South. The curved line SAN is True North and South.



When a small part of this map is enlarged (*e.g.* CD) there is on grid line on the map which is True North and South. The deviation of the grid line from True North must therefore be allowed for, and it was usual to insert this on the maps at points E or F.

(c) *The magnetic variation of a particular compass is rarely the same as the correct variation* (as was shewn, *e.g.*, on the map) *for the locality in which it is being used.* The compass has an error which must be deducted from or added to the correct magnetic variation.

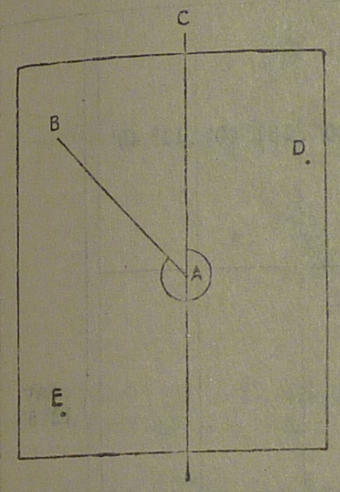
So long as reference is made to a True North, the above three things complicate work with map and compass, *e.g.*, suppose the machine gunner desired to lay out a line of fire by compass to a target shewn on the map. In obtaining the bearing from the map he had to allow first for the fact that the grid lines were not True North and South (and this was often difficult because the difference was not clearly shewn); and secondly for the error of his particular compass. Finally he had to remember whether the magnetic variation had to be added or subtracted. It is therefore better, as is now done on maps, to omit True North altogether, and work simply by Compass North and Grid North as follows:—

(i.) Find the magnetic variation of your compass from the grid lines on map.

(ii.) Measure all bearings with reference to the grid lines on the map.

(iii.) To convert a grid bearing into a compass bearing, add (in France) the magnetic variation of your compass: and conversely to convert a compass bearing into a grid bearing, subtract (in France) this variation.

To find the magnetic variation of a compass from the grid lines on the map.



Select two distant points A and B, which are mutually visible on the ground and which are accurately marked on the map.

With the compass, take three separate bearings from A to B.

Take the mean of these three bearings as being the correct magnetic bearing of the compass from A to B (Say 324° 40′).

On the map, measure the bearing of AB with reference to the Grid North and South line passing through A (*i.e.*, AC). (Say 312° 20′).

Then the magnetic variation of that particular compass from this map, is 324° 40′ − 312° 20′ = 12° 20′.

Repeat the above process on a second object D, and again on a third object E. Three values for the compass variation will thus be obtained, and the average value may be taken as correct.

NOTE.—It will generally be found that the variations of the compass obtained from different points do not differ by more than 30 min., and the average value may be taken; but where the variations differ by more than 1 deg. it will be necessary to note the variation in each direction. This difference is due to the compass cards being incorrectly centred. Where the error is considerable it is best to procure a new compass.

Sec. 2.

The above results can be conveniently arranged as follows:—

	Map Location from which bearings are taken	Map Location on which bearings are taken	Magnetic bearing	Mean Magnetic bearing	Grid bearing	Variation	Average Compass Variation
1.	R.21.d. 42·60	R.28.c. 10·14	(i.) 143° 10′ (ii.) 143° 30′ (iii.) 143° 20′	143° 20′	131° 40′	11° 40′	
2.							, say, 12° 5′
3.							

The compass variation must be found for every new map and in every fresh locality.

2. RESECTION.

The position on the ground being known, to find it on the map.

Accuracy is essential at every stage.

(i.) Find out your exact compass variation.

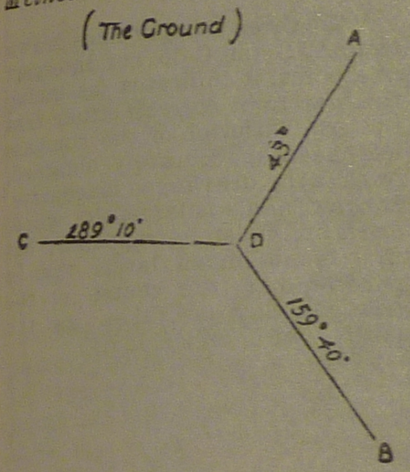
(ii.) Take several accurate bearings and take the mean as correct.

(iii.) Avoid metal likely to affect the compass readings.

(iv.) Draw carefully with a hard sharp pencil.

(v.) Whenever possible fix the position on the map by the detail close at hand rather than by resection.

Method A. Using compass.



The observer at D, wishing to fix the position of D on the map, selects two points A and B, visible on the ground and accurately marked on the map, and whenever possible a third point C, which checks the position of D, as fixed by AD and BD.

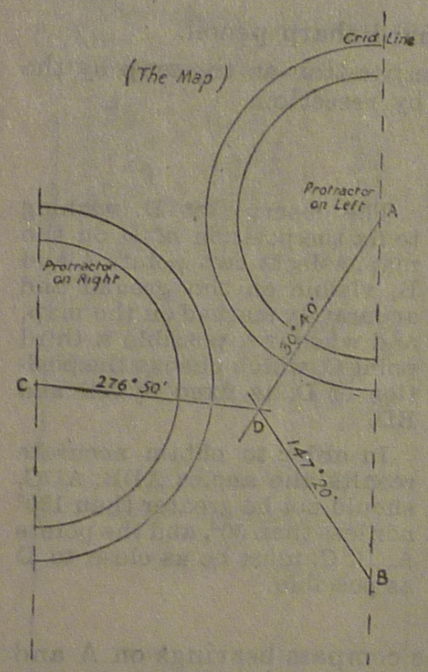
In order to obtain accurate results, the angles ADB, ADC, should not be greater than 130° nor less than 50°, and the points A, B, C, must be as close to D as possible.

The observer at D takes three compass bearings on A and finds the average bearing. He repeats this on B and then on C.

From these bearings he obtains the grid bearings to A, B and C, by subtracting his compass variations from each.

Object taken	Average Compass Bearing	Grid Bearing	
A.	43°	30° 40′	When the grid variation of the compass is 12° 20′.
B.	159° 40′	147° 20′	
C.	289° 10′	276° 50′	

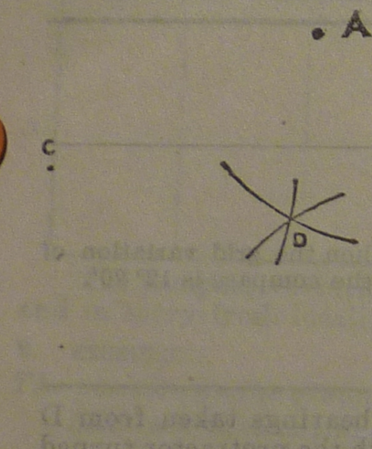
To plot these resections, plot the bearings taken from D at the points identified on the map, with the protractor turned to the right for bearings over 180 deg. and turned to the left for bearings under 180 deg. This is quite simple with a protractor graduated in both directions.



If the three straight lines drawn from A, B and C do not intersect at a point, it indicates (assuming the map to be correct) either that the grid variation of the compass has been inaccurately obtained, or that the drawing is inaccurate. If the triangle is large, the whole operation must be repeated; but if it is not much larger than a pencil point, the centre of the triangle may be taken as the position of D on the map.

Method B. Using a range-finding instrument.

This method is very useful when it is impossible to use a compass. The instrument must be accurately adjusted.



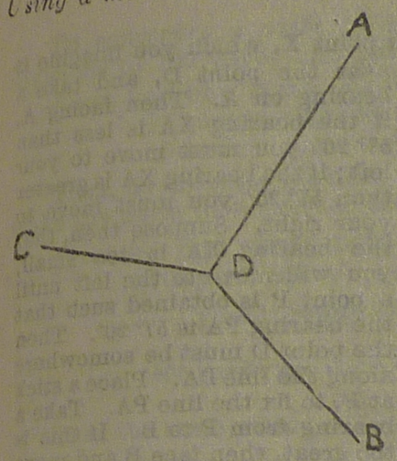
From D, the point whose position on the map is desired, take the range to three points A, B and C. These should be as near as is consistent with the minimum reading of the instrument (250 yards on the Barr and Stroud).

Then with a pair of compasses stretch the distance AD by the scale on the map, and with compass point at A, draw an arc. Repeat this for B and C, and the point of intersection of the three arcs will be the position of D.

In this case also, a triangle at D and not a point indicates inaccuracy, and the same rule applies as in Method A.

Method C. Method of super-position.

Using a machine gun with direction dial, or a compass.



From D find the angles ADB, BDC and CDA by laying on A, B, C, in succession and reading off the angles on the direction dial.

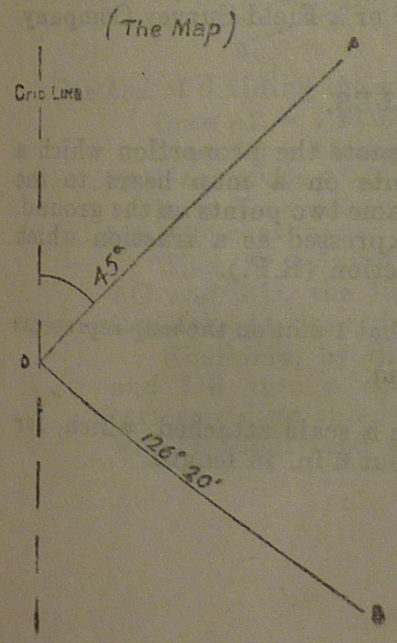
Then on a piece of transparent paper draw a line AD, and from D draw a line DB so that the angle ADB = the angle ADB found above. Similarly draw DC making the angle CDB = the angle CDB found above.

Place this transparent paper on the map, so that DA passes through A on the map, DB through B on the map, and DC through C on the map. With a pin, prick through the point D, and the point thus obtained will be the position of D on the map.

NOTE.—The best results will be obtained when the points A, B, C are near D.

Instead of the Direction Dial the compass may be used. Take bearings on A, B and C. By subtracting the bearing of A from that of B obtain the angle ADB, and by subtracting the bearing of B from that of C obtain the angle BDC.

The position on the map being known, to find it on the ground.



Select two points A and B which are recognisable on the ground and are marked on the map.

On the map join A and B, to D.

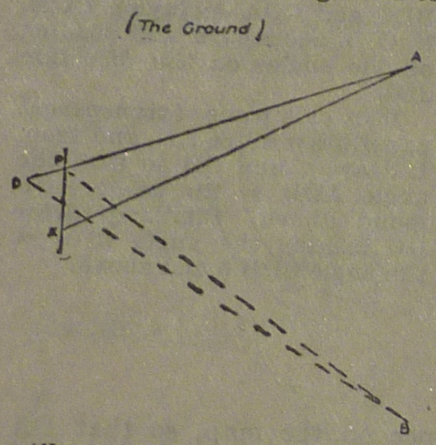
Through D draw a line parallel to the grid lines of the map, and by laying the centre of the protractor on D find the grid bearings from D to A, and B. Convert these bearings to compass bearings, by adding the compass variation.

Then with a compass variation of 12° 20′

From D the compass bearing to A = 45° + 12° 20′ = 57° 20′

From D the compass bearing to B = 126° 20′ + 12° 20′ = 138° 40′.

Proceed next on the ground to a point X, which you imagine is near the point D, and take a bearing on A. Then facing A, if the bearing XA is less than 57° 20′ you must move to your left; if the bearing XA is greater than 57° 20′ you must move to your right. Suppose then, that the bearing XA is too small, you will move to the left until a point P is obtained such that the bearing PA is 57° 20′. Then the point D must be somewhere along the line PA. Place a stick at P, to fix the line PA. Take a bearing from P to B. If this is too great, then face B and move to the right along the line AP until a point D is obtained such that the bearing DB is 138° 40′.



Then D is the point required, because the bearing DA is 57 deg. 20 min., and the bearing DB is 138 deg. 40 min., which was required.

NOTE.—(i.) As a final check, the bearing on a third point should be obtained.

(ii.) Whenever possible, fix the position D by detail close at hand.

When the obliteration of all landmarks makes resection impossible, it is sometimes possible to get the position fixed by the help of the Field Artillery or a Field Survey Company.

3.—SCALES.

The word scale is used to denote the proportion which a distance between any two points on a map bears to the horizontal distance between the same two points on the ground. This same proportion can be expressed as a fraction which is called the Representative Fraction (R.F.).

Thus R.F. $= \frac{1}{20,000}$ indicates that 1 unit on the map represents 20,000 of the same unit on the ground.

A sketch should always have a scale attached, which, for convenience of use, should be about 6 in. in length.

To construct a scale of 12 inches to the mile, showing divisions of 100 yards and sub-divisions of 20 yards:—

First, find how many yards are represented by 6 inches.

12 inches represents 1,760 yards.

∴ 6 inches represents 880 yards.

Then, as the scale must be divided into hundreds of yards, make the scale to represent 800 yards.

Secondly, find what length of line will represent 800 yards.

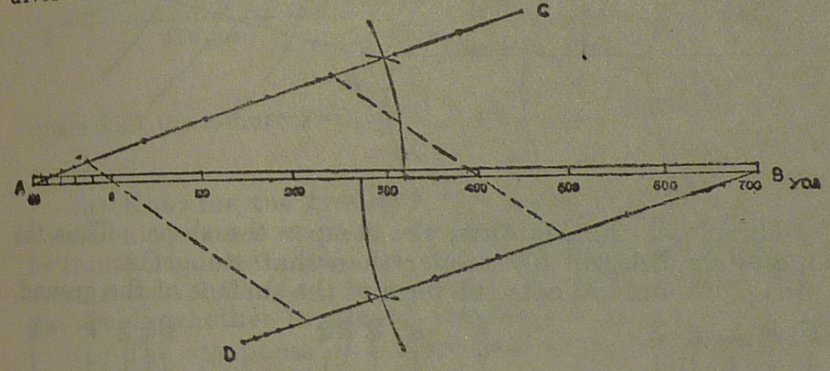
1,760 yards are represented by 12 inches.

∴ 1 yard is represented by $\frac{12}{1,760}$ inches.

∴ 800 yards are represented by $\frac{12}{1,760} \times \frac{800}{1}$ inches.

Then the scale must be $\frac{12 \times 800}{1,760} = 5{\cdot}45$ inches.

Thirdly, draw a line 5·45 inches, and divide it into 8 equal parts, each division representing 100 yards. Divide the left division into 5 equal parts, each representing 20 yards.



Method of dividing the scale into parts:—

Draw AB = 5·45 inches.

Draw AC = 4 inches (this length being easily divisible by 8), and divide AC into eight equal parts.

Draw BD = AC and parallel to AC and divide it also into eight equal parts.

Then by joining the corresponding divisions of AC and BD, the line AB will be divided proportionately as desired.

Similarly, by dividing the left divisions of AC and DB into 5 equal parts and joining up the corresponding sub-divisions, the left division of AB will be subdivided as desired.

Sec. 4.

4.—CONTOURS.

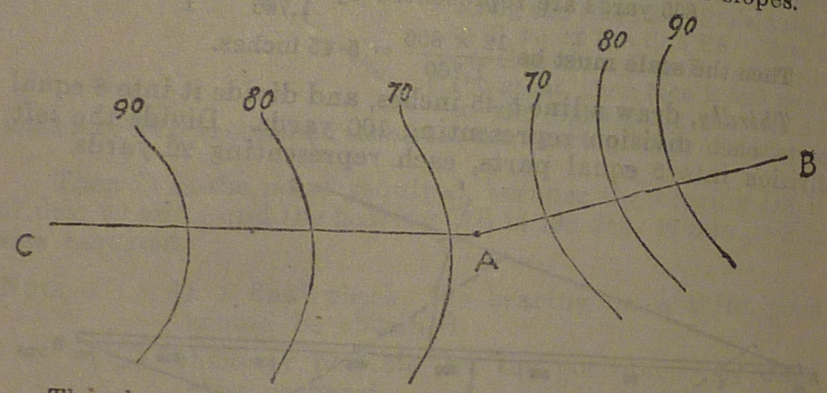
1. DEFINITION.

"The representation of an imaginary line running along the surface of the ground, at the same height above mean sea-level throughout its length."

Only a certain number of these lines are drawn on the map, and the heights of intermediate points must be estimated. Generally on our maps of 1/10,000 and 1/20,000, contours shew each vertical distance of 10 metres, which is called the Vertical Interval between the contours.

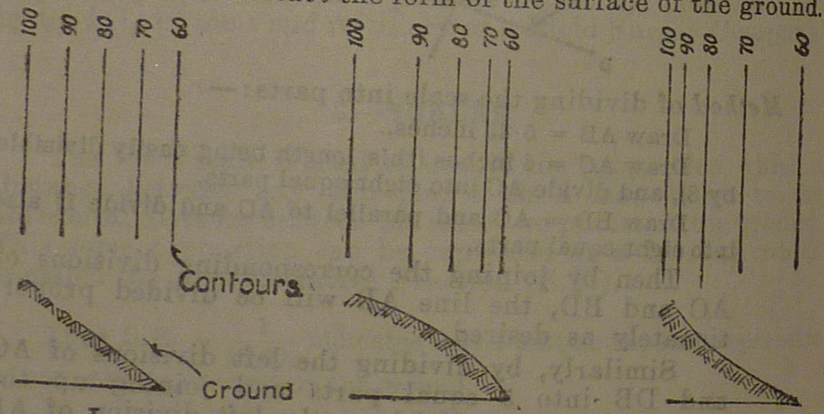
2. EXAMINATION OF A MAP.

(i.) Contours indicate the relative steepness of slopes.



The closer the contours, the steeper the slope. Thus the slope along BA will be steeper than that along CA.

(ii.) Contours indicate the form of the surface of the ground.

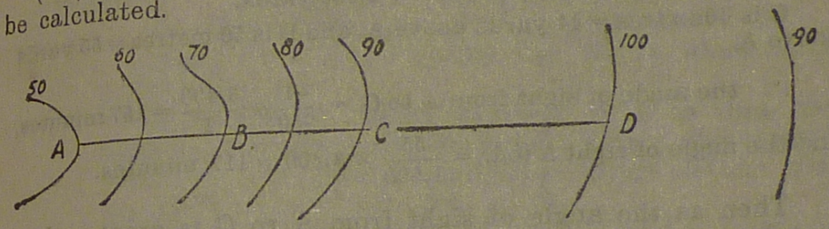


I.
Contours equidistant. Slope uniform.

II.
Contours becoming closer, going from high to low ground. Surface is convex and there will be dead ground.

III.
Contours becoming wider, going from high to low ground. Surface concave, and there will not be dead ground.

(iii.) From contours the gradient, or steepness of slope, can be calculated.

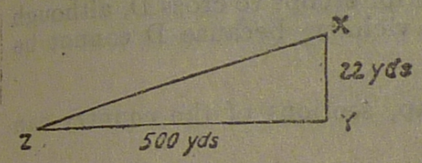


(AB = 500 yards).

Example:—The slope A to B is required.

Suppose AB = 500 yards. (= ZY).

B is 20 metres = 22 yards above A. (= XY).



Then the gradient is "22 in 500," or written as a fraction $= \frac{22}{500} = \frac{1}{22 \cdot 7}$ The steepness of the slope can also be measured by the angle XZY. (*See* Section 45.)

Angle XZY (in minutes) $= \frac{XY}{ZY} \times 3{,}400 = \frac{22}{500} \times 3{,}400 = 149'$

Practical uses.

(*a*) Knowing the gradient, it is possible to judge whether a road on a reverse slope in the enemy's territory will be used by transport or not; for it is very improbable that a gradient greater than 1-10 (*i.e.*, 6 deg.) will be used. From this we can decide whether to fire on the road or not.

(*b*) The steepness of a slope will decide in the selection of routes for transport.

If the gradient is 1-20 (*i.e.*, 3 deg.), even on a good road, time must be allowed to breathe the horses.

On a gradient of 1-10 (*i.e.*, 6 deg.), a horse can only draw one quarter of the load it can draw on the level.

(*c*) Knowing the slope of the ground fired on, several deductions can be made of probable fire effect. (*See* "Fire effect in relation to slope of ground." Sec. 49, para. 2.)

(iv.) From contours, one can find whether two points are mutually visible.

Example:—See Diagram in (iii.).

Is the point D visible from the point A? C is the point likely to cause the obstruction.

Sec. 4.

Now AC = 950 yards, and AD = 1,600 yards.

C is 40metres = 44 yards above A, and D is 50 metres = 55 yards above A.

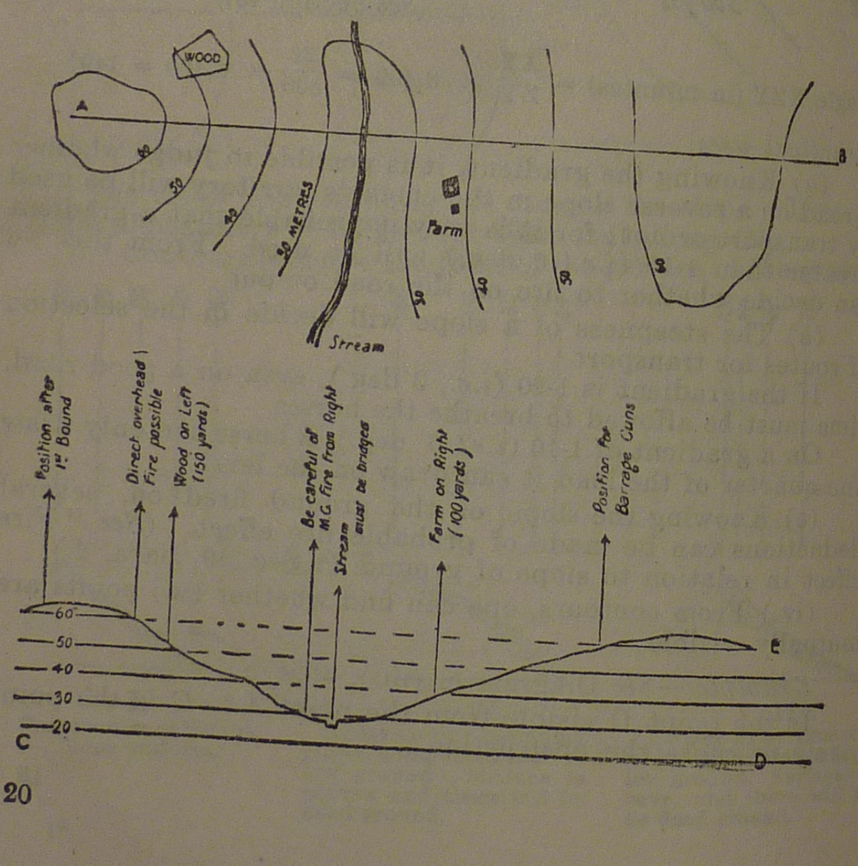
∴ the angle of sight from A to C = $\frac{44}{950} \times \frac{3,400}{1}$ = 157 minutes,

and the angle of sight A to D = $\frac{55}{1,600} \times 3,400$ = 117 minutes.

Then as the angle of sight from A to C is greater than that from A to D, the point D is not visible from A.

The practical use of the above would be in selecting routes of advance either for troops or for transport. For instance in the previous diagram, suppose we hold C and the enemy holds A, it would be safe for troops to cross D, although D is the highest point in the vicinity, because D cannot be seen from A.

(v.) From a contoured map, sections of the country can be made.



Sec. 4.

In the above contours, to make a section from A to B:—

Join AB on the map.

Draw CD = AB, marking the points where each contour cuts AB.

Draw DE to some convenient scale to shew the vertical intervals of the contours. Plot in the vertical section of the ground: and then insert details that are likely to be of practical value.

A section thus constructed will be useful, for example, for shewing troops the kind of ground over which they have to advance, especially if aeroplane photographs are difficult to obtain.

For purposes of study, the construction of such sections is one of the best ways of appreciating the different problems connected with contours.

CHAPTER III.

FIRE DIRECTION.

5.—THEORY OF FIRE.

1. TECHNICAL TERMS.

Axis of the bore.—An imaginary line following the centre of the bore from breech to muzzle.

Line of sight.—The straight line passing through the sights and the point aimed at.

Trajectory.—The curved path taken by the bullet in its flight to the target.

Cone of fire.—The figure formed in the air by the trajectories of the outermost shots of a burst of fire.

Culminating point.—The highest point of the trajectory above the line of sight.

Its position is approximately 6-10 of the range.

First catch.—The point where the lowest bullet has descended sufficiently to strike the head of a man, whether mounted, standing, kneeling, lying, etc.

First graze.—The point where the lowest bullet, if not interfered with, will first strike the ground.

Beaten zone.—The area of ground beaten by a cone of fire.

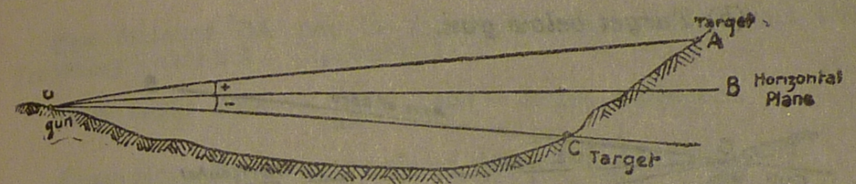
(i.) The length is great compared with the width.

(ii.) The dimensions of the beaten zones of the Vickers gun have never been satisfactorily measured, and recent experiments with average guns and average firers indicate that the beaten zones are longer and narrower than the official dimensions in Appendix IV., Table I.

Effective beaten zone.—The area of ground beaten by the best 75 per cent. of the shots.

Drift.—The term used to express the lateral deviation of the bullet, brought about by its gyroscopic action, after it has left the barrel. Experience indicates that for purposes of machine gun fire drift need not be taken into consideration.

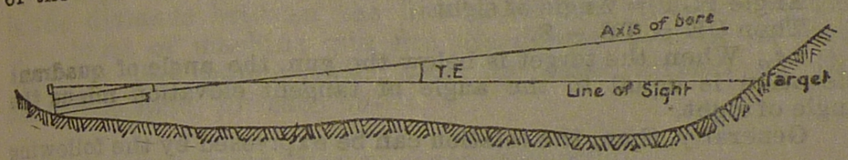
Angle of sight.—The angle contained between the line of sight and the horizontal plane.



Angle AGB = angle of sight for target A.
Angle BGC = ,, ,, ,, ,, ,, C.

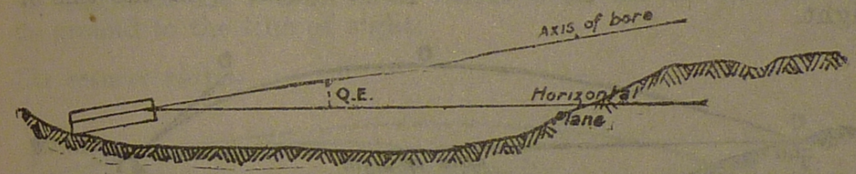
By convention, the angle is said to be positive (+) when the target is above the H.P., and is negative (−) when the target is below the H.P., through the gun position.

Angle of tangent elevation.—The angle between the axis of the bore and the line of sight.



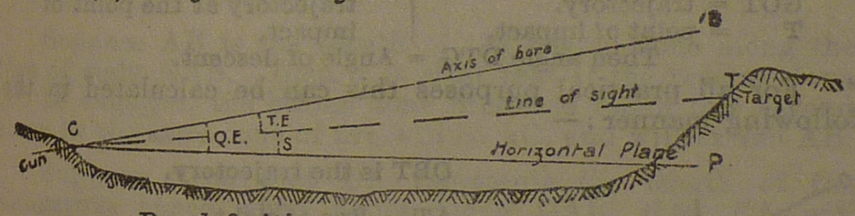
T.E. is the angle of tangent elevation.

Angle of quadrant elevation.—The angle between the axis of the bore and the horizontal plane.



Relation between angles of quadrant elevation (Q.E.), angle of tangent elevation (T.E.), and angle of sight.

(a) *Target above gun.*

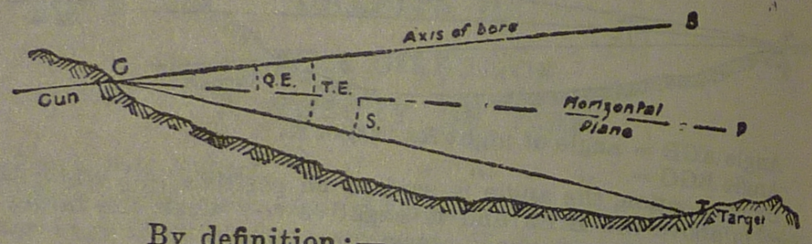


By definition:—
Angle BGP = Angle of quadrant elevation.
Angle BGT = Angle of tangent elevation.
Angle TGP = Angle of sight.
Then QE = TE + S.

i.e., When the target is above the gun, the angle of quadrant elevation is equal to the angle of tangent elevation, plus the angle of sight.

Sec. 5.

(b) Target below gun.



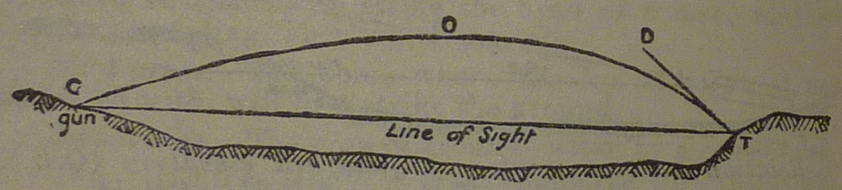
By definition :—

Angle BGP = Angle of quadrant elevation.
Angle BGT = Angle of tangent elevation.
Angle PGT = Angle of sight.
Then QE = TE − S.

i.e., When the target is below the gun, the angle of quadrant elevation is equal to the angle of tangent elevation minus the angle of sight.

Generally, then, the relation can be expressed by the following formula :—$QE = TE \pm S$.

Angle of descent.—The angle which the tangent to the trajectory, at the point of impact, makes with the line of sight.

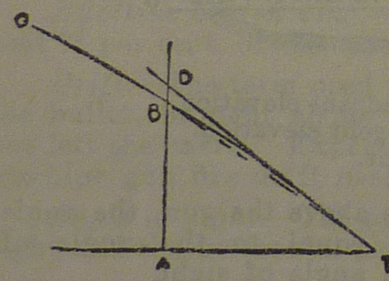


GT = line of sight.
GOT = trajectory.
T = point of impact.

DT is the tangent to the trajectory at the point of impact.

Then angle DTG = Angle of descent.

For all practical purposes this can be calculated in the following manner :—



OBT is the trajectory.

AT = line of sight.

DT = tangent at point of impact.

Then if AT = 100 yards, the trajectory BT will be practically coincident with the tangent DT, and we can assume that the angle BTA = DTA.

The distance BA can be found for any range, from the Trajectory Table 2 A. (Appendix IV.)

Then angle $BTA = \frac{BA}{AT} \times 3{,}400$ = Angle of Descent.

Example:—Find the angle of descent for 1,800 yards.

From Table 2 A find the height BA, *i.e.*, the height of the 1,800 yards trajectory at 1,700 yards. This equals 12 yards.

Then angle of descent = $\frac{BA}{AT} \times 3{,}400 \frac{12}{100} \times 3{,}400 = 408$ min.

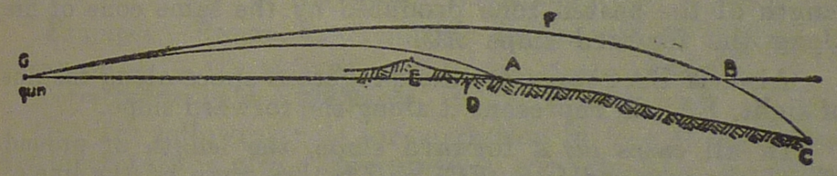
(Compare Table I., Column 3).

Dangerous space.—For one bullet, the dangerous space is the distance between the first catch and the first graze. In a burst of machine gun fire the *danger zone* is an area equal to the beaten zone, *plus* the area formed by the dangerous space for each bullet.

2. FIRE EFFECT IN RELATION TO SLOPE OF GROUND.

On level ground the length of the beaten zone varies considerably with the range; but also at any particular range the length of the beaten zone varies with the inclination of the ground to the line of sight.

The reverse slope.



Suppose AB is the length of the beaten zone along the line of sight GAB. Then it is clear that if the reverse slope AC be engaged, the beaten zone produced along this reverse slope by the same cone of fire will be AC, and will exceed AB.

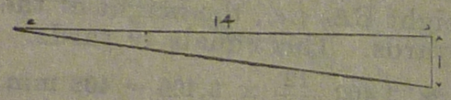
Suppose, also, that DA represents the length of the dangerous space when firing along GAB, then EA will represent the length of the dangerous space when firing on the reverse slope.

Along the line of sight, therefore, fire effect will be produced for a distance DB, but on a reverse slope fire effect will be produced for a distance EC, and this distance (as will be shown later) will greatly exceed DB.

On a reverse slope the ratio of the length of AC to that of AB at any range can be found as follows:—

$$\frac{AC}{AB} = \frac{\text{Angle of descent}}{\text{Angle of descent} - \text{Angle of slope of ground}} = \frac{FBA}{FBA - BAC}$$

Example:—Range 2,000 yards. Slope of ground 1 in 14.



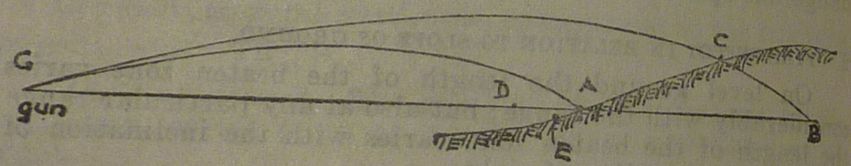
NOTE.—If the ground slopes 1 in 14, the angle of slope $= \frac{1}{14} \times 3{,}400 = 251'$.

Also angle of descent at 2,000 yards $= 541'$,

$$\frac{AC}{AB} = \frac{541}{541 - 251} = \frac{541}{290} = 1{\cdot}8.$$

Therefore AC is 1·8 times (*i.e.*, nearly twice) the length of AB at 2,000 yards when the ground slopes 1 in 14.

The forward slope.



Again let AB represent the length of the beaten zone along the line of sight GAB. Then AC will represent the length of the beaten zone produced by the same cone of fire along the forward slope AC.

Also, if DA represents the dangerous space along the line of sight, EA will represent it along the forward slope.

In all cases on a forward slope, the length of ground effectively engaged (*i.e.*, EC) will be less than on the line of sight (*i.e.*, DB).

On a forward slope, the ratio of the length of AC to that of AB is found as follows:—

$$\frac{AC}{AB} = \frac{\text{Angle of descent}}{\text{Angle of descent} + \text{Angle of slope of ground}} = \frac{CBA}{CBA + CAB}$$

Example:—Range 1,500. Slope of ground 1 in 12 (*i.e.*, angle of slope $= 298'$).

$$\frac{AC}{AB} = \frac{251}{251 + 298} = \frac{251}{549} = \frac{5}{11}$$

Thus AC will be less than half the length of AB, at 1,500 yards when the ground slopes 1 in 12.

3. CLIMATIC INFLUENCES AND THEIR ALLOWANCES.

The following are the normal atmospheric conditions for the Sighting of Small Arms:—

(i.) Barometric pressure. 30 inches. (Sea level.)
(ii.) Temperature. 60 deg. Fahrenheit.
(iii.) Still air.
(iv.) A horizontal line of sight.

(*A*) *Atmospheric variations that affect elevation.*

When the barometer rises above 30 inches, more elevation than is normally required for the distance will be necessary, owing to the greater resistance offered to the bullet by the denser atmosphere. If the barometer falls below 30 inches, as is the case in damp weather, or at a height above sea level, less elevation will be required, as the atmosphere will offer reduced resistance to the bullet. In the same manner the bullet meets with less resistance in hot weather when the thermometer is high, and greater resistance in cold weather when it is low.

(i.) The following rule for correction in case of variation in barometric pressure is approximately correct:—

For every inch the barometer rises or falls above or below 30 inches, add or deduct 1½ yards for each 100 yards of range.

When the barometer rises, add—*vice versâ*.

Example:—Range, 2,000 yards. Barometer, 29 inches.

Allowance $= 1 \times 1\frac{1}{2} \times 20 = 30$ yards. (Deduct this.)
Corrected range = 1,970 yards.

(ii.) The following rule for correction in case of variation in temperature is also approximately correct:—

For every degree which the temperature rises or falls above or below 60 deg., deduct or add 1-10 yards for each 100 yards of range.

Example:—2,100 yards. Temperature, 50 deg.

$$\text{Allowance} = \frac{1}{10} \times (60 - 50) \times \left(\frac{2{,}100}{100}\right)$$

$$= \frac{1}{10} \times \frac{10}{1} \times \frac{21}{1} = 21 \text{ yards.} \quad \text{(Add this.)}$$

Corrected range = 2,121 yards.

(iii.) The following rule for correction in case of head or rear winds is approximately correct:—

$$\text{Allowance in yards} = \frac{\text{Speed of wind in miles per hour} \times \text{Time of flight.}}{2}$$

Sec. 5.

If an oblique wind, divide the speed by two, and call it head or rear, as the case may be. (*See* also Note (iv.) below.)

Example:—Wind from left front at 20 M.P.H. Range 1,950 yards. This wind is equivalent to a head wind of 10 M.P.H.

Then allowance = $\frac{10 \times 6}{2}$ = 30 yards.

Corrected quadrant elevation = 1,980 yards.

Table 4, Appendix IV., has been introduced to save these lengthy calculations, and, with practice, the corrected range for any atmospheric conditions can be worked out in less than half a minute.

(*B*) *Atmospheric variations that affect direction.*

A side wind acts on the greater surface of the bullet, and has consequently more influence on its flight than a wind blowing from the front or rear.

One must also note that, owing to the increased time during which the bullet is exposed to the effect of wind, and to the height attained in its flight, the allowance for wind at long range is out of all proportion to that necessary at short range.

The following table will act as a rough guide:—

Range.	Lateral Allowances. (*cf.* Table 5, App. IV.)					
	Mild. 10 M.P.H.		Fresh. 20 M.P.H.		Strong. 30 M.P.H.	
Yards.	Yards.	Minutes.	Yards.	Minutes.	Yards.	Minutes.
500	1	5	1½	10	2	15
1,000	3	10	6	20	9	30
1,500	6	15	12	30	18	45
2,000	12	20	24	40	36	60
2,500	24	30	48	60	72	90

Notes:—

(i.) Halve the allowances for oblique winds. (*See* Note iv.)

(ii.) For direct fire the minutes of angle should be used in conjunction with a card and string, in order to obtain an

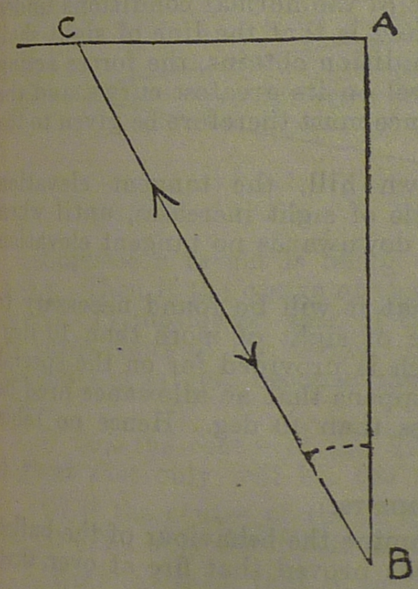
auxiliary aiming mark. If there is no aiming mark available use the following rough rule:—

Assume the following factors:—Mild 2. Fresh 3. Strong 4. Then multiply the range by the appropriate factor, and the first figure of the answer gives the taps required.

Example:—Fresh wind at 1,500 yards:
1,500 × 3 = 4,500: Order 4 taps.

(iii.) For indirect fire make the allowance in minutes of angle, either by the Deflection Bar Foresight, or with a "T" Aiming Mark placed 9½ yards away, so that one inch lateral distance will represent 10 minutes.

(iv.) The rule that oblique winds should be halved in order to find the equivalent head, rear, or side wind is only very approximately correct, and when greater accuracy is required the following table should be employed to determine what ratio of the wind will act in the direction of the line of fire, *i.e.*, affect the elevation, and what ratio will act at right angles to the line of fire, *i.e.*, affect the direction.



BA gives the line of fire.

The direction of the wind may be CB or BC.

Angle A.B.C.	Ratio of wind affecting elevation.	Ratio of wind affecting direction.
10° } 20° }	1	¼
30° } 40° }	¾	½
50° } 60° }	½	¾
70° } 80° }	¼	1

Example:—An oblique head wind of 20 miles per hour is blowing at an angle of 30 deg. to the line of fire. Then this is equivalent to a head wind of 20 x ¾, *i.e.*, 15 M.P.H., and a side wind of 20 x ½, *i.e.*, 10 M.P.H.

(*C*) *Effect of not having a horizontal line of sight.*

As previously stated, one of the normal conditions under which a machine gun is sighted is that the line of sight shall be horizontal. When this condition obtains, the forces acting on the bullet cause it to travel on its greatest curve, and the elevation for any given distance must therefore be given to the gun.

When firing up or down hill, the tangent elevation required gets less as the angle of sight increases, until when firing vertically upwards or downwards no tangent elevation is required at all.

It is very improbable that it will be found necessary to engage a target at an angle of sight of more than 10 deg. (except hostile aircraft, which is provided for on the special sights issued), and it also happens that no allowance need be made for angles of sight less than 10 deg. Hence no table for correction is necessary.

4. RESULTS OF RECENT EXPERIMENTS.

Experiments made to examine the behaviour of the bullet at ranges of about 3,000 yards proved that fire at over that range will be of very little value.

The shape and size of each beaten zone would appear to vary with each burst fired, and the area beaten is always very large. This is no doubt due to the fact that the bullets attain

a great height, and are influenced by many varying air currents.

The bullet also appears to fall sideways, sometimes pointing to the right and sometimes to the left, indicating that it has ceased to rotate with its point foremost.

The power of penetration was also tested, and the bullet was able to penetrate into 1½ inches of soft wood.

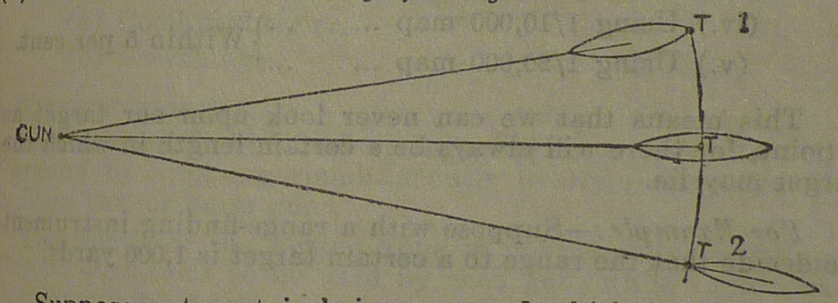
On the other hand, barrage demonstrations at 2,500 and 2,600 yards prove that accurate and effective firing can be produced at these ranges.

Other experiments showed that new barrels shoot higher than old ones, and that after 20,000 rounds the bullets drop short about 5 per cent. of the range.

6.—COMBINED SIGHTS, SEARCHING AND TRAVERSING.

1. PERMISSIBLE AND PROBABLE ERRORS IN RANGE FINDING.

(*a*) *Permissible error in range finding.*



Suppose a target is being engaged which is 1,000 yards away. Then if the centre of the effective beaten zone hits the target (T) the lowest shot of the E.B.Z. will hit the ground 70 yards short of the target, and the highest shot 70 yards beyond the target, because the length of the E.B.Z. is 140 yards.

If now the centre of the E.B.Z. falls 70 yards short, the highest shot only will hit the target (T1).

Or if the centre of the E.B.Z. falls 70 yards beyond the target (T2), only the lowest shots will hit the target.

It is clear then, that if an error of more than 70 yards is made in obtaining the distance to the target (T), the whole of the fire effect will be lost, because the target will not be hit. Seventy yards can be called the permissible error, and it is half the length of the effective beaten zone.

In general, the length of beaten zone decreases, as the range increases, and consequently the permissible error *decreases* as the range increases.

(*b*) *Probable error in range finding.*

Whether the fire be direct or indirect, the range to any given target can rarely be obtained with complete accuracy, and the magnitude of this probable error depends on the method employed in obtaining the range.

The following table will act as a rough guide:—

(i.) Using range-finding instrument, 5 per cent. error.

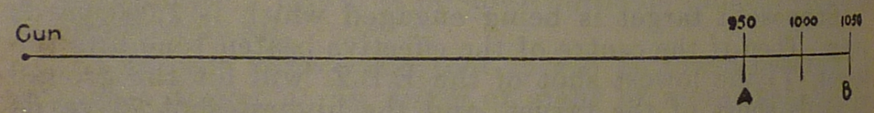
(ii.) Using a range card built up from key ranges, the key ranges being found by instrument, and the intermediate ranges by judging distance ... ... 10 per cent. error.

(iii.) Judging distance (by eye) ... 15 per cent. error.

(iv.) Using 1/10,000 map ... ...
(v.) Using 1/20,000 map ... ... } Within 5 per cent.

This means that we can never look upon our target as a point, for there will always be a certain length in which the target may lie.

For Example:—Suppose with a range-finding instrument we decide that the range to a certain target is 1,000 yards.



Then as an error of 5 per cent. may have been made either way, the target may be anywhere between the points A and B; and to ensure hitting the target, we must produce fire effect on the whole of the line AB.

AB in this case is twice the probable error, and = 2 × 5 per cent. of the range.

It is clear that the greater the range, the greater the probable error will be. For example, in this case considered above, the probable error is 50 yards, but if the range had been 2,000 yards, the probable error would have been 100 yards.

To consider the permissible and probable errors together:—

Example:—Range 2,000 yards, using range-finding instrument.

Ground to be searched = 2 × 5% of range = 200 yards.
Permissible error = 35 yards.

Example:—Range 1,500 yards, using key ranges.

Ground to be searched = 2 × 10% of range = 300 yards.
Permissible error = 40 yards.

Example:—Range 1,000 yards, using judging distance method.

Ground to be searched = 2 × 15% of range = 300 yards.
Permissible error = 70 yards.

Therefore, in practically all cases, it is necessary to increase the depth of the beaten zone considerably in order to ensure fire effect.

There are two methods of doing this:—

(*a*) Combined sights.
(*b*) Searching.

2. COMBINED SIGHTS.

Definition:—The method of engaging any required depth of ground by applying simultaneously overlapping zones of fire from two or more guns.

The depth of the beaten zone is increased by ordering different elevations to be used by each gun, while each uses the same aiming mark.

In direct fire these different elevations are put on by ordering each gun to fire with a different elevation on the tangent sight. In indirect fire the same effect is produced by ordering a different quadrant elevation for each gun.

Rule for combined sights.

"Always use as many guns as possible, with 100 yards' differences if the error in range finding is probably considerable, and with 50 yards differences if the error in range finding is probably small."

Explanation of the result produced.

Example:—Range 1,500 yards (as found by range-finding instrument) 3 guns available.
50 yards differences will be used. (Rule. above).

Then for direct fire, the order will be:—

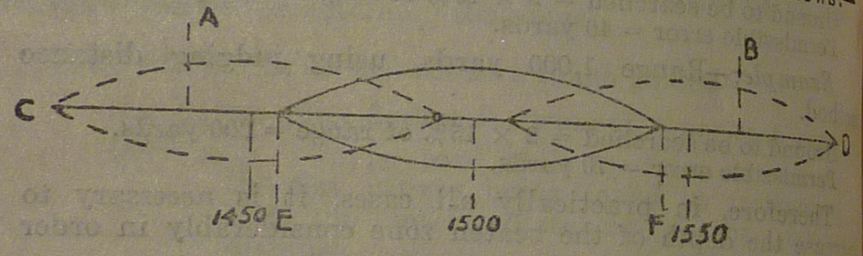
"1450 yards—50 yards differences."

For indirect fire, the order will be:—

"Elevation 2° 5′—10′ differences.

(The angle of sight is assumed to be nil: the tangent elevation for 1,450 yards = 2° 5′, and that for 1,550 yards = 2° 25′.)

In each case the result at the target will be as follows:—



AB = 150 yards = Ground to be searched = (2 × 5% of range).

CD = Depth of E.B.Z. produced = 180 yards.

EF = Length of each E.B.Z. = 80 yards.

From this diagram it is clear that the likelihood of hitting the target (which lies between A and B) is greatly increased, but, as the fire is spread out, the density will be greatly diminished. Consequently, whenever observation of fire can be obtained, the controller must cease using combined sights, and fire with all the guns at the correct elevation to hit the target.

"Combined sights" is specially useful when surprise effect is desired, because each portion of the ground in which the target probably lies is beaten simultaneously.

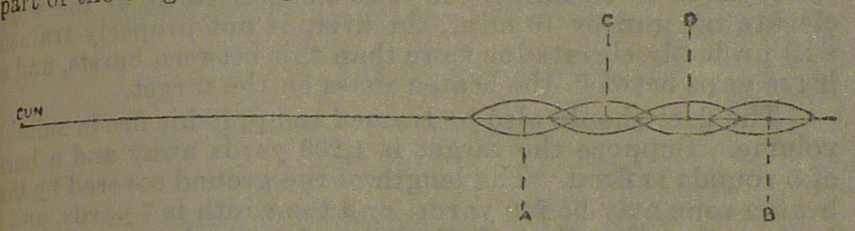
NOTE.—When the target is itself a depth of ground, *e.g.*, a wood, combined sights will be maintained, even though fire effect on a particular part of the target has been observed. (*See* para. 4 below.)

3. SEARCHING.

Definition:—The method of engaging any required depth of ground by applying successively overlapping zones of fire from one gun.

On comparing this method with combined sights, it will be seen that searching is of little value when surprise effect

is desired, because, whereas in combined sights each part of the target is engaged simultaneously, in searching each part of the target is engaged successively.

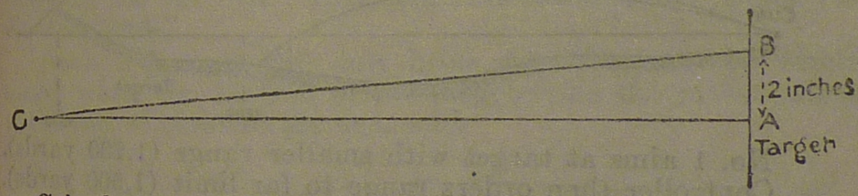


Suppose the target lies somewhere between the points A and B; then to ensure hitting it, the whole distance AB must be engaged.

The firer places a burst on A, then elevates his gun and places another on C, then on D, and continues until the whole line has been covered.

It requires much skill on the part of the firer to avoid gaps between bursts, and proficiency can only be obtained by constant practice on the 25 yards' range.

The firer is taught on the 25 yards' range to turn the elevating wheel after firing a burst, so that the next burst of fire is two inches above the first. This is called the "Normal" or "Two-inch" turn.



G is the gun position.

A and B the positions on the target of two bursts of fire, the necessary elevation being given to the gun after the first burst to raise the point of impact to B, which is two inches above A.

Using the V.I. formula:—

$$\text{The angle B.G.A.} = \frac{2 \times 3400}{25 \times 36} = 8 \text{ minutes (nearly)}$$

i.e., the two-inch turn elevates the gun eight minutes.

Alterations in elevation are made by turning the elevating wheel, and it must be impressed on the firer that the required turn is a very small one.

For example, when firing at 1,100 yards (tangent elevation 73 min.), an elevation of 13 min. will throw the beaten zone 100 yards forward (because the tangent elevation for 1,200 yards is 86 min.). As two normal turns of the wheel elevate the gun by 16 min., the firer, if not properly trained, will probably elevate for more than this between bursts, and so leave gaps between the beaten zones on the target.

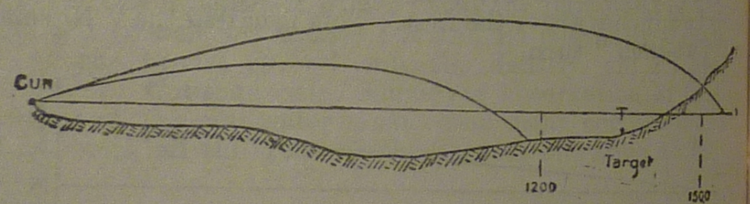
The firer should also be trained to apply his fire in suitable volume. Suppose the target is 1,200 yards away and a burst of 5 rounds is fired. The length of the ground covered by the beaten zone may be 240 yards, and the width is 7 yards, and it is clear that the effect of 5 bullets on such a large area will be very small. Bursts of 20 or 30 rounds should be fired, or even more, if there is reason to suppose that the target is a dense one.

When searching is being employed to overcome errors in range-finding (the object at present under discussion) the following is the procedure:—

The controller decides between what limits the target lies (say, between 1,200 yards and 1,500 yards).

He then orders range to near limit (*i.e.*, 1,200 yards).

Then he indicates the target.



No. 1 aims at target with smaller range (1,200 yards).

Controller then orders range to far limit (1,500 yards).

No. 1 alters his sights to 1,500 yards without elevating the gun.

No. 1 fires bursts and elevates until aiming at the target with 1,500 yards.

Then, providing that the target lay between 1,200 yards and 1,500 yards, it will have been effectively engaged.

4. There is also another important use of combined sights and searching, which arises when the target is itself longer than the beaten zone which can be produced by one gun.

In this case the total length of ground which must be searched can be found by adding the length of the target to twice the probable error.

When using combined sights, a point in the *centre* of the target will be employed as an aiming mark (if the centre is not visible, the near end), and the controller will decide from the number of guns available and from the length of the target, whether he should use 100 yards or 50 yards differences in order to cover the whole target.

If the target is on a forward slope it will generally be advisable to use 100 yards' differences, in order to counterbalance the shortening of the beaten zone which arises when firing on such a slope.

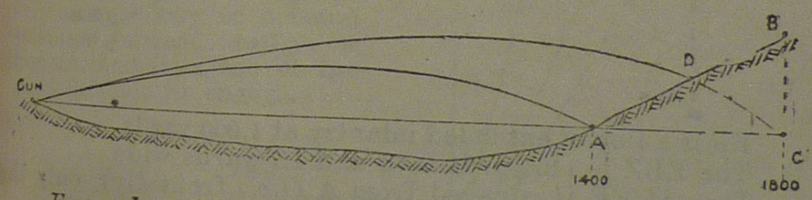
Example:—AB is a road, the near end being 1,200 yards and the far end 1,600 yards from the gun.

Then although a distance CD (400 yards) is covered *along the line of sight* (because all guns will have the same line of sight to T), only a part of the road AB will be covered, namely EF.

In order to cover as much of AB as possible, spread out the fire by ordering 100 yards' differences.

If such a target be engaged by the method of searching, the existing rule needs modification. This rule states:—"The firer will aim at the near end of the target with the range to hit it. Then run his tangent sight slide to the range to the far end. Then fire and elevate until aiming at the *near* end."

Such a process will only bring fire effect on the whole target when the far end of the target is on the prolongation of the line of sight to the near end.



Example:—AB is a long target on a forward slope, A being 1,400 yards, and B 1,800 yards from the gun. If the

existing rule be followed, the firer will elevate until aiming at A with 1,800 yards on his sights, but although his fire would, in the absence of ground at D, go to a point C, 1,800 yards along the line of sight, it will not touch B the far end of the target.

In such an instance the rule must be altered; the firer should fire and elevate until aiming at the *far* end of the target.

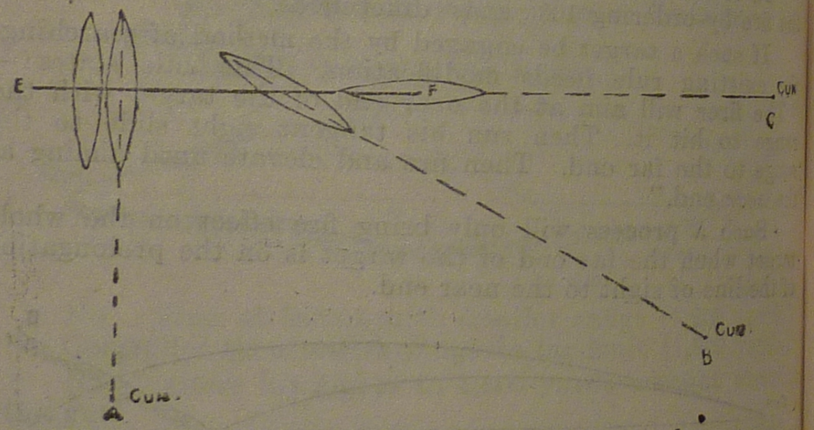
4. TRAVERSING.

Definition.—The method of engaging any required width of ground by distributing laterally against it the fire of one or more guns.

The normal way of engaging a wide target is to aim at one extremity, fire a burst and then tap and fire alternately until the whole target has been covered.

The firer is taught on the 25 yards' range the required strength of tap to cause the horizontal distance between bursts to be two inches on the target at 25 yards. This is called the "Regulation two-inch tap." It is equivalent to a traverse of eight minutes (*see* "Two-inch turn," page 35).

If the object in view is to bring fire effect on a belt or an area of ground (as in a barrage) this method is very effective. But if the target is a thin line of extended infantry, or a trench running at right angles to the line of fire, traversing is wasteful. In such cases the best fire effect is obtained by firing in enfilade, or as obliquely to the target as possible.



EF is a line of extended infantry at 1,000 yards.

The EBZ is 140 yards long and 1.7 yards wide.

Then if EF is engaged from A (*i.e.*, frontally), only the width of the EBZ can be counted as effective (1.7 yards).

If EF is engaged from C (*i.e.*, in enfilade), the whole length of the EBZ (*i.e.*, 140 yards) can be counted as effective. The fire effect produced will then be 80 times as effective from C as from A.

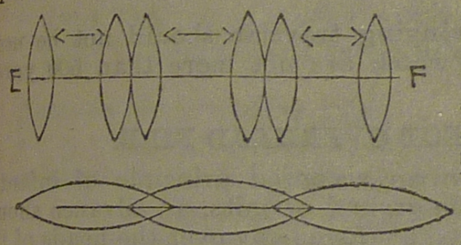
From B (*i.e.*, obliquely), the fire effect will be greater than from A, and the effect will increase the nearer the fire approaches to enfilade.

It will also be seen that the time taken to cover the whole Target EF from B will be much less from B than from A.

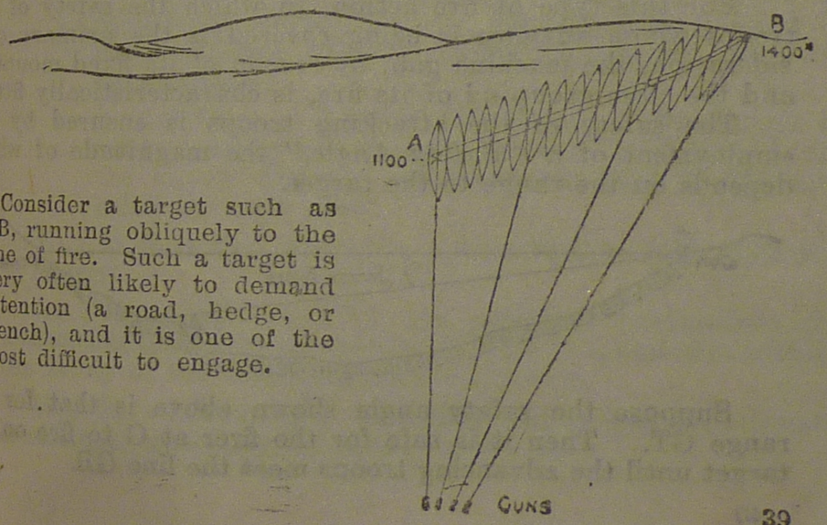
Every endeavour, therefore, should be made to reduce traversing to a minimum, and to engage targets from oblique or enfilade positions.

NOTE.—In the above example EF is looked upon as one single target, which it is better to engage EF from C than from any other position.

If, however, the object in view is to make a certain line EF impassable to the enemy, it is better to engage it frontally, provided sufficient guns are available to do this effectively, because then the enemy will be bound to pass through a deep belt of ground beaten by machine gun fire, whereas if the same object is attempted by enfilade guns, only a very narrow belt of ground is effectively engaged.



5. OBLIQUE TRAVERSING.



Consider a target such as AB, running obliquely to the line of fire. Such a target is very often likely to demand attention (a road, hedge, or trench), and it is one of the most difficult to engage.

The best way is to use a combination of combined sights, searching and traversing.

For example, with four guns, order:—

1,100 yards, 100 yards' differences.
Road—Four points of aim.
Oblique traversing.
Fire.

Each No. 1 will then traverse along his own portion of the target, keeping his line of sight on the target.

It will then be unnecessary to order any one gun to use different elevations.

6. SWINGING TRAVERSE.

This is a method of engaging a wide target by firing continuously, and at the same time distributing the fire along the whole target.

It necessitates loosening the traversing clamp, which allows the gun to vibrate more than in ordinary traversing, and it is therefore not so accurate as the normal method of traversing.

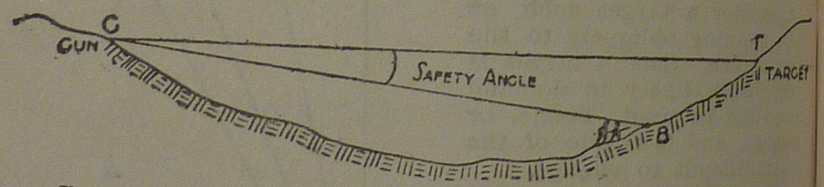
Consequently the swinging traverse should not be used except at dense targets which are not more than 500 yards distant.

7.—DIRECT OVERHEAD FIRE.

1. It has long been an accepted principle of infantry tactics that, whenever the ground permits, an advance should be assisted by fire directed at the enemy over the heads of the assaulting troops.

For this type of fire action, in which the safety of the troops whose advance is being covered is the primary consideration, the machine gun, by reason of its fixed mounting and the close grouping of its fire, is characteristically fitted.

The safety of the attacking troops is ensured by the employment of a "Safety Angle," the magnitude of which depends on the range to the target.



Suppose the safety angle shown above is that for the range GT. Then it is safe for the firer at G to fire on the target until the advancing troops meet the line GB.

2. RULES FOR DIRECT OVERHEAD FIRE.

(i.) If the range to the target is 1,000 yards or under, the safety angle is 30 min.

If the range to the target is between 1,000 and 1,500 yards, the safety angle is 60 min.

If the range to the target is over 1,500 yards, the safety angle is 100 min.

NOTE.—If the ground is comparatively flat between the gun and the target, closer support may generally be given by using the methods of indirect fire, if it is possible for these methods to be used.

(ii.) Direct overhead fire must not be employed if the attacking troops are more than 2,000 yards from the gun.

(iii.) The range to the target must be known to within 5 per cent.

(iv.) A worn barrel or a worn tripod must not be used.

(v.) No. 1 must be a good firer.

(vi.) The tripod must be well dug in.

(vii.) The target and our own troops must be clearly visible.

Notes on the preceding rules.

* (i.) The calculation of the safety angles given in Rule (i.) is based on the following allowances:—

(*a*) That a maximum error of 5 per cent. of the range may have been made in range-finding.

(*b*) That the lowest bullet may fall short an additional 10 per cent. of the range on account of bad holding, aiming, worn barrel or defective ammunition.

(*c*) Over and above the allowance for errors in range finding and firing, allowance is also made for the known distance of the lowest shot of the cone below the centre shot.

(ii.) In Rule (ii.), there is no limit to the range from gun to *Target*.

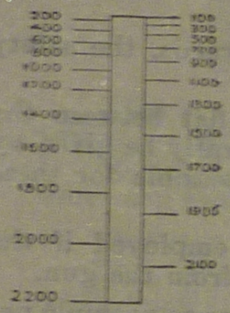
(iii.) Rules (iii.) to (vii.) are practical precautions for minimising the errors allowed for in Rule (i.), and thus making the safety of the attacking troops absolute.

(iv.) In addition, the controller will allow for climatic conditions, especially for head winds.

3. METHODS OF APPLYING SAFETY ANGLES.

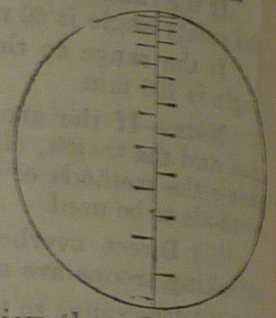
Method I.—By graticules.

Card.



(Card held at the distance denoted on the card from the eye.)

Field glasses.

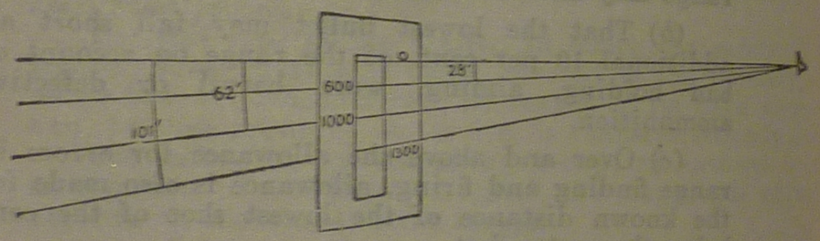


(View through graticuled glasses.)

It should be noticed at the outset that graticules were designed for indirect fire (*see* Sec. 9), and consequently the use of graticules for direct overhead fire is more or less accidental.

But it so happens that on looking through graticules (whether on a card or on graticuled glasses) the angle formed at the eye by the zero line and the 600 yards line is 28 min.

Similarly the angle between zero and 1,000 is 62 min., and the angle between zero and 1,300 yards is 101 min.



These three angles are very close approximations to the angles laid down in Rule 1, and the error involved in using them as 30 min., 60 min. and 100 min. is negligible.

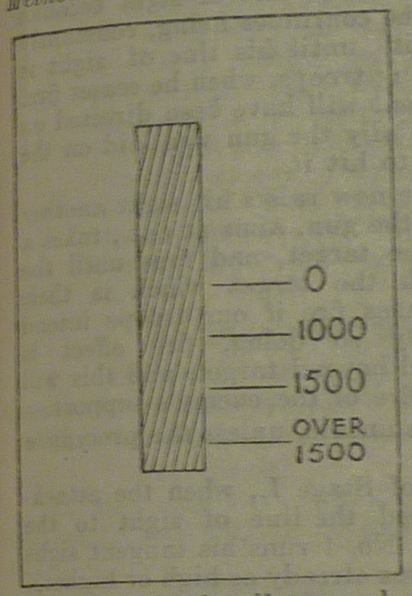
The procedure is to align the graticule so that the line from the controller's eye through the zero mark is on the target.

Then the line passing through the 600 yards' graticule will give the safety limit when the range to the target is 1,000 yards or under (*i.e.*, safety angle of 28 min.).

The line passing through the 1,000 yards graticule will give the safety limit when the range to the target is between 1,000 and 1,500 yards (*i.e.*, safety angle of 62 min.).

The line passing through the 1,300 yards graticule will give the safety limit when the range to the target is more than 1,500 yards (*i.e.*, safety angle of 101 min.).

Method II.—Special safety angle graticule card.



(Card held at the distance denoted on the card from the eye.)

The card is aligned so that the line from the controller's eye through the zero mark is on the target.

Then the line marked "1,000" will give a safety angle of 30 min. The line marked "1,500" will give a safety angle of 60 min., and the line marked "over 1,500" will give a safety angle of 100 min.

The controller, observing Rule 1, and knowing the range to the target, will know which line to use for any particular instance.

Method III.—Tangent sight method.

In the two methods given above, the controller alone knows how far it is safe to support the advance. If he should become a casualty, the firer will be in danger either of supporting the advance beyond the safety limit, or of ceasing fire too soon, in which case the attacking troops will lose the effect of his covering fire.

A second objection to the two previous methods is that only three safety angles are permissible. This in itself is

unsound, because the safety angle necessarily varies with every variation in the range.

Both difficulties are overcome by the following method:—

Stage I.—The firer lays on the target with the range to hit it. Then, without moving the gun, he runs up his sights 300 yards higher, and finds at which point on the ground he is now aiming.

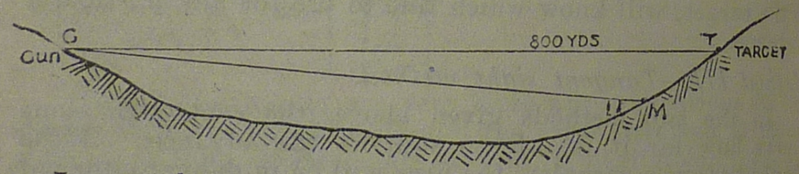
This position on his new line of sight becomes his aiming mark, and he continues firing, constantly checking his aim on it, until his line of sight is touched by the advancing troops, when he ceases fire. The fire up to the present will have been directed on the target, because initially the gun was laid on the target with the range to hit it.

Stage II.—The firer now raises his sight another 200 yards and elevates the gun, aims at (*i.e.*, takes a line of sight on to) the target, and fires until the attacking troops reach the target which is their objective, when he ceases fire if our troops intend advancing further. By so doing, fire effect is produced on the ground beyond target, and this will help to neutralize the fire of the enemy's support.

At close ranges Stage II. is unsafe, unless the procedure is modified as follows:—

At the completion of Stage I., when the attacking troops have touched the line of sight to the auxiliary aiming mark, No. 1 runs his tangent sight slide to 1,300 yards (unless already as high or higher), lays on the target and fires until the attacking troops reach the target.

Example:—Range to target, 800 yards.



Lay on the target with 800 yards on the sights.

Alter tangent sight to 1,100 yards (*i.e.*, 300 yards higher), use the point M thus found, as aiming mark.

Fire until the attacking troops touch the line G.M.

Then cease fire, *and set sights at 1,300 yards.*

Aim at the target, and continue firing until the advancing troops reach T. Then cease fire.

4. CONCLUSION.

In the absence of factors which obstruct the field of view (mist, smoke screens, the smoke and dust caused by artillery, etc.), the foregoing methods of direct overhead fire are technically reliable. But because one or other of these factors either is or may be present, arrangements for indirect fire should be made as stated in Part I., Section 15, and they should be of the following nature:—

Once the gun has been laid on the target, an auxiliary aiming mark should be put out for the purpose of maintaining elevation and direction, and the maximum time during which the advance can be supported should be obtained either by estimating the rate of advance or by obtaining it from the artillery time-table. Thus, the point up to which the attacking troops can advance with safety being known, it can be decided how long fire may safely be directed on the target.

8.—INDIRECT FIRE (GENERAL).

1. *Indirect fire is fire directed by any other means than laying the gun over the sights on to the target.*

Indirect fire may be carried out by guns controlled:—

(*a*) Singly.

In this case the line of fire of each gun is laid out separately, and without reference to the line of fire of another gun.

(*b*) Batteries.*

In this case the lines of fire of the guns constituting the battery are laid out in parallel directions, and these form a basis from which the controlling officer can issue an order producing:—

(*a*) Distribution of fire along any line.

(*b*) Concentration of fire on any locality.

Where possible, registration should always be carried out.

As this is often impossible, reliance must be placed upon the theoretical rules which underlie the application of indirect fire.

Unless these rules, their limitations and applications are clearly understood, accurate indirect fire is impossible, the safety of the troops, over whose heads the fire is being directed,

* See Note at end of Index.

may become endangered, and the expenditure of S.A.A. is not justified.

For example, unless the officer carrying out the fire has a knowledge of his probable errors in direction and elevation, he may either:—

(*a*) By searching an area unnecessarily large (in order to obtain fire effect on the target) obtain a very small material result; or

(*b*) By searching an area too small, miss the target altogether.

If the necessary care is taken, accurate indirect fire can be carried out with the present equipment of the gun.

In order to test this possibility, tests have been carried out over a period of six months. These have been undertaken by different squads of officers under instruction, under varying weather conditions.

The targets were six 10 ft. by 3 ft. screens placed one behind the other, but on the side of a hill, so that one shot could not hit more than one target. The map location of the targets was given to the officers carrying out the test.

In all cases elevation was placed on the gun by clinometer and one belt was fired.

No traversing was allowed, as the tests were designed to show the errors in direction.

The following results were obtained:—

Gun position fixed by detail on the map.

Range, 1,200 yards.

I.—Direction by compass.

No. of tests, 20. Average error in direction, 30 min.

II.—Direction by reference object.

No. of tests, 22. Average error in direction, 15 min.

Gun position fixed by resection.

No points nearer than 1,000 yards were allowed to resect from.

Range, 1,450 yards.

III.—Direction by compass.

No. of tests, 17. Average error in direction, 15 min.

IV.—Direction by reference object.

No. of tests, 21. Average error in direction, 30 min.

The results show that with care the degree of error should not exceed 30 min., therefore a total traverse of 1 deg. should include the target.

To carry out indirect fire with accuracy and rapidity entails a high standard of professional efficiency on the part of the officer. He must have a thorough knowledge of:—

(*a*) Maps.
(*b*) The compass and its "characteristics."
(*c*) The tables and graphs which give—
(i.) Angles of elevation and descent.
(ii.) Dimensions of cones and beaten zones.
(iii.) Methods of determining quadrant elevation.
(iv.) Methods of determining clearances.
(v.) Allowances for atmospheric conditions.
(*d*) Methods of laying and fire control.
(*e*) The technical equipment in use.
(*f*) Probable errors.

2. Indirect fire will be dealt with under the following headings:—

Indirect fire of guns controlled singly.

I. Without the map (*i.e.*, where a 1/20,000 or larger scale contoured map is not available).
(*a*) By graticules.
(*b*) By angle of sight instrument or director.

II. With the map (*i.e.*, where a 1/20,000 or large scale contoured map is available).
(*a*) To obtain direction.
(*b*) To obtain elevation.

Indirect fire of guns controlled in batteries.

I. With the map.
II. Without the map.

Maintaining laying.
Clearances.
Night firing.
Searching reverse slopes.
Errors.
Barrage fire.

9.—INDIRECT FIRE OF GUNS CONTROLLED SINGLY.

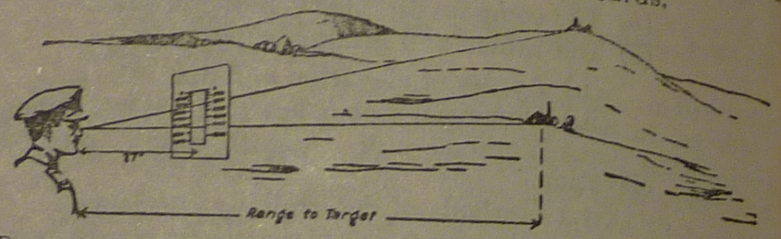
1. INDIRECT FIRE WITHOUT THE MAP.

A. *By use of graticules.* (*See* Sec. 7.)

The following instruments are required:—

(i.) Barr and Stroud range-finder.

(ii.) Field glasses in which graticules are cut across the focal plane, or graticule cards.



Procedure.

(i.) Move to a position from which the target can be observed. (This should not be more than 6 feet above the gun, and at approximately the same range from the target.)

(ii.) Obtain range to target.

(iii.) Select a suitable aiming mark, visible to the gun, which is vertically above or below the target, and in alignment of gun and target.

(iv.) Observe the target so that the graticule representing the range falls across the target.

(v.) Note which graticule cuts the aiming mark, and the corresponding range.

(vi.) Order the No. 1 of the gun to put this range on his tangent sight and lay on the aiming mark.

This method gives accuracy of direction but not great accuracy of elevation. The fire effect is greatly enhanced when observation can be obtained.

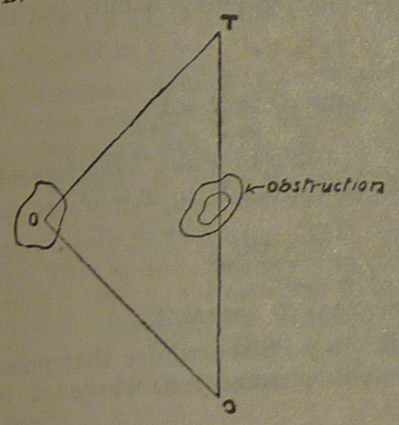
NOTE 1.—As the range on the sight is not the range to the target, the fire cannot be corrected by ordering "up 50" or "down 50," etc. (since the ratchet is uniform, and an alteration of one click elevates or depresses the gun through the same angle, no matter what position of the slide, the correction is applied by alteration by clicks).

There are roughly as many clicks in the ratchet of the tangent sight as there are hundreds of yards in the range, at all ranges below 1,500 yards.

For example, if the range is 1,200 yards, and fire is 100 yards short, the controlling officer orders "up 12 clicks." The No. 1 moves his slide up 12 clicks and relays on the auxiliary aiming mark.

NOTE 2.—Where a suitable auxiliary aiming mark can be seen above or below the target, this method is useful to bring fire to bear on a target which is visible through glasses, and is difficult to indicate to the No. 1.

B. *By the TOG method.*



The figure shows the
Gun position, G.
Target position, T.
Observation station, O.
The following instruments are required:—

1. Barr and Stroud range-finder.
2. Director and angle of sight instrument, or some means of measuring the angle TOG and angles of sight.

Procedure.

To obtain direction:—

After selecting the gun position the Controlling Officer goes to a position from which he can see both the gun and the target, and—

(1) Takes ranges to the gun and to the target with the Barr and Stroud.

(2) Measures the angle TOG.

This is done:—

(*a*) With a director, by laying it on G and T in turn, and noting the angle swung through.

(*b*) Without a director by taking bearings to G and to T, and then the difference between these bearings is the angle TOG.

The ranges OT, OG, and the angle TOG being known, it is now simple to find the range GT, and the angle TGO.

This is done:—

(*a*) With the "plotter."

(*b*) Without the "plotter." Draw a line to represent the range OT, set off the angle TOG with a protractor, and mark off the point G, so that OG represents the range OG. Measure the angle TGO with the protractor.

Order the gun to lay on the observation station and lay off the angle TGO. An aiming post is now set out, and the gun is laid for direction.

To obtain elevation:—

Take the angle of sight from O to T = t°
O to G = g°

This is done with an "angle of sight" instrument.

To find the angle of sight from G to T = S° use the formula:—

$$S^\circ = \frac{t^\circ \times OT - g^\circ \times OG}{GT}$$

NOTE.—*See* Theory of Fire, Sec. 49, para. 1.

The angle of sight to a point is positive where that point is above the position of observation, negative where it is below.

Having found the angle of sight S, find the TE for the range GT and the Q.E. from the formula.

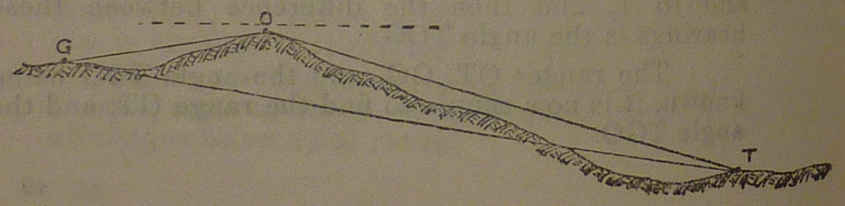
$$Q.E. = T.E. \pm S.$$

Order this Q.E. to be placed on the gun.

The gun is now laid for direction and elevation. Where observation can be obtained fire can be corrected by ordering "30 min. left," etc. – "up 20 min."

The fire control is best carried out by telephonic communication from O to G—or where this is not possible, by visual signalling.

Where the observation post is in the direct line from the gun to the target, direction can be obtained by placing posts, and elevation as follows:—



Let:—

OT = Range from crest to target.
OG = Range from crest to gun.
t° = Angle of sight from crest to target.
g° = Angle of sight from crest to gun.

Then angle of sight from gun to target = S°

$$S^\circ = \frac{t^\circ \times OT - g^\circ \times OG}{GT}$$

and GT = OG + OT approximately.

This "TOG" method can be easily adapted to guns employed in a battery. (*See* Sec. 10, para. 5.)

2. INDIRECT FIRE WITH THE MAP.

The map must be at least 1/20,000 and contoured.

A. *To obtain direction.*

Method 1. *By map and compass.*

(i.) *The position of the gun on the ground must be accurately fixed on the map.*

This is done either:—

(*a*) From the detail on the ground and comparing this with the detail on the map; or

(*b*) if this is not possible, by resection.

Any of the methods described in Sec. 2, para. 2, may be used.

Where time permits greater accuracy is ensured by employing one method and checking with another.

It may be possible to obtain the aid of a Field Survey Company where a very accurate location is necessary.

The use of oblique aeroplane photographs has been found helpful when moving guns forward to positions already sited in territory previously hostile.

(ii.) *The magnetic bearing from the gun to the target must now be found.*

To do this:—

(*a*) Draw a line on the map from the gun position to the target.

(*b*) Using the protractor, measure the bearing this line makes with any North and South Grid line. This is the grid bearing from the gun to the target.

(*c*) Add the magnetic variation of the compass from the North and South Grid lines. The result is the magnetic bearing from the gun to the target.

NOTE 1.—(*c*) Applies only to places where the magnetic variation is West.

If the variation is East, subtract instead of add.

NOTE 2.—The variation of the compass must be determined for each compass for the particular map in use, and should be constantly checked. (*See* Sec. 2, para. 2.)

(iii.) *To lay the gun on the magnetic bearing so obtained.* This can be done in the following ways:—

(*a*) Place a post (not more than 6 inches high) in the gun position and place the compass on the top of the post. Rotate the compass until the card reads the required bearing.

Align an aiming post on this bearing using the hair line on the compass. Place the gun with the centre of the cross at the bottom of the socket, immediately over the post, and lay on the aiming post.

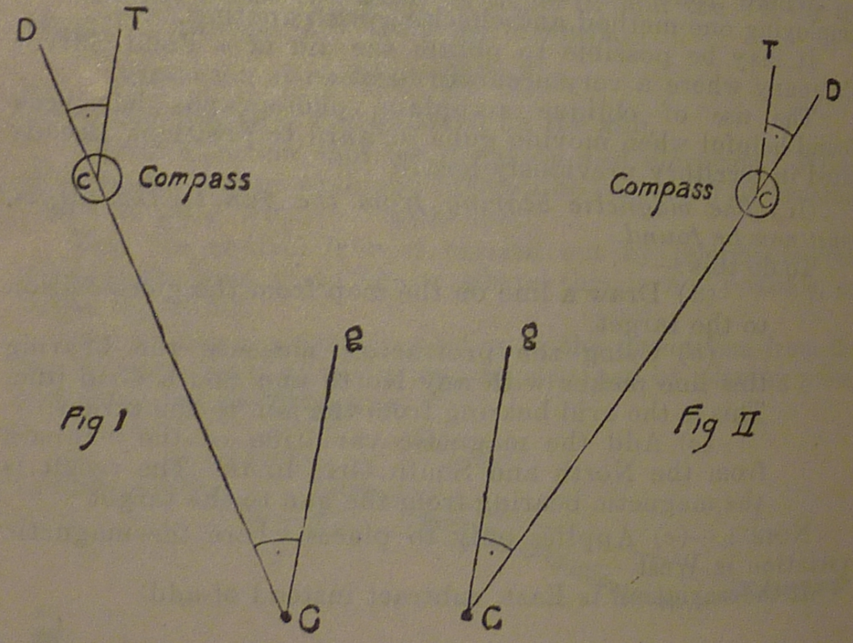
(*b*) By use of the compass tower.

See Appendix VIII.

(*c*) It may often be impossible owing to the presence of iron to use a compass from the gun position itself. Take the compass out more or less in the required line of fire, either in front of, or behind the gun.

Two cases now occur:—

1. *Compass in front of gun.*



The figures shew:—

1. CG the bearing from compass to gun.
2. CD the back bearing.
3. CT the bearing on which the gun is required to fire.
4. Gg the line of fire obtained by laying off the angle gGC, which = the angle TCD.

NOTE.—Since the angle gGC = the angle TCD gG is parallel to CT, and the gun is laid on the bearing required.

Rule.

1. Take the compass 30 to 50 yards in front of the gun more or less in the direction of fire. Lay the gun on the compass. Take the bearing CG on to the gun.

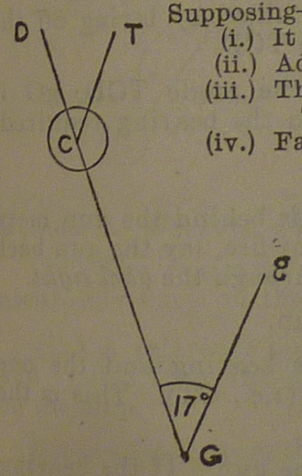
2. Obtain the back bearing CD.

3. Obtain the angle between this bearing and the one on which it is required to lay the gun (*i.e.*, CT). This is the angle TCD.

4. The observer at C now turns his back on the gun, and faces the direction CD—if the bearing on which it is required to fire the gun (*i.e.*, CT) lies to his right, the gun lays off the angle TCD to the right—and if to his left, the angle TCD is laid off to the left.

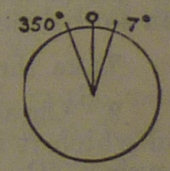
The gun is now laid on the required bearing in the direction Gg, which is parallel to CT; and an aiming post is put out.

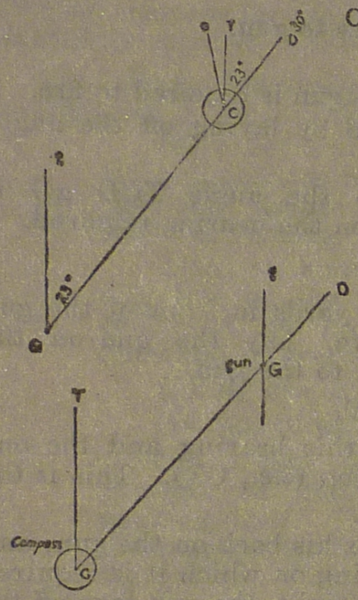
Example:—To lay a gun on a magnetic bearing of 7 deg.



Supposing—

(i.) It is found that bearing CG=170°.
(ii.) Adding 180° the back bearing CD=350°
(iii.) The difference between a bearing of 350° and 7°=17°.
(iv.) Facing CD the bearing CT lies to the right. Therefore the gun lays off 17° to the right,





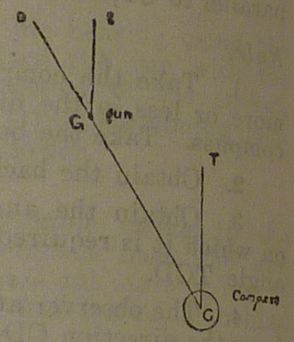
Or again it may be ound that—

(i.) Bearing CG = 210°.

(ii.) Subtracting 180° the back bearing CD = 30°.

(iii.) The angle TCD = 30° − 7° = 23°.

(iv.) Facing CD the bearing CT lies to the left; therefore the gun lays off 23° to the left.



Compass behind gun.

The figures shew:—

(i.) CG the bearing from compass to gun.

(ii.) CT the bearing on which the gun is required to fire.

(iii.) Gg the line of fire obtained by laying off the angle gGD, which = the angle TCD.

NOTE.—Since the angle gGD = the angle TCD, gG is parallel to CT, and the gun is laid on the bearing required.

Rule.

1. Take the compass 30 to 50 yards behind the gun more or less in the prolongation of the line of fire, lay the gun back on to the compass from the *foresight* through the *backsight*.

Take the bearing CG on to the gun.

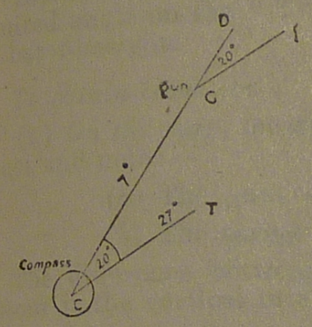
2. Obtain the angle between this bearing and the one on which it is required to lay the gun (*i.e.*, CT). This is the angle TCD.

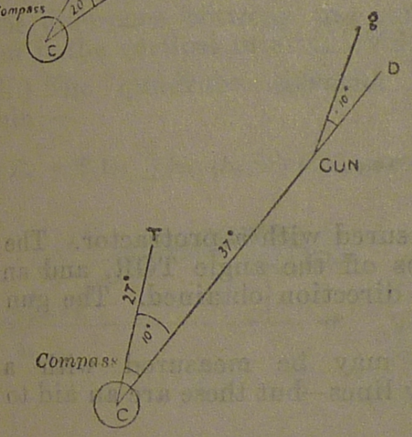
3. The observer at C, now faces the gun. If the bearing

on which it is required to fire the gun lies to his right, the gun lays off the angle TCD to the right—and if to his left, the angle TCD is laid off to the left.

The gun is now laid on the required bearing in the direction Gg, which is parallel to CT; and an aiming post is put out.

Example:—To lay a gun on a magnetic bearing of 27 deg.





Supposing:—

1. It is found that bearing CG = 7 deg.

2. Difference between a bearing of 27 deg. (*i.e.*, CT) and 7 deg. = 20 deg.

3. Facing CD the bearing CT lies to the right, therefore the gun lays off 20 deg. to the right.

Or, again, it may be found that:—

1. Bearing CG = 37 deg.

2. Difference between a bearing of 27 deg. (*i.e.*, CT) and 37 deg. = 10 deg.

3. Facing CD the bearing CT lays to the left, therefore the gun lays off 10 deg. to the left.

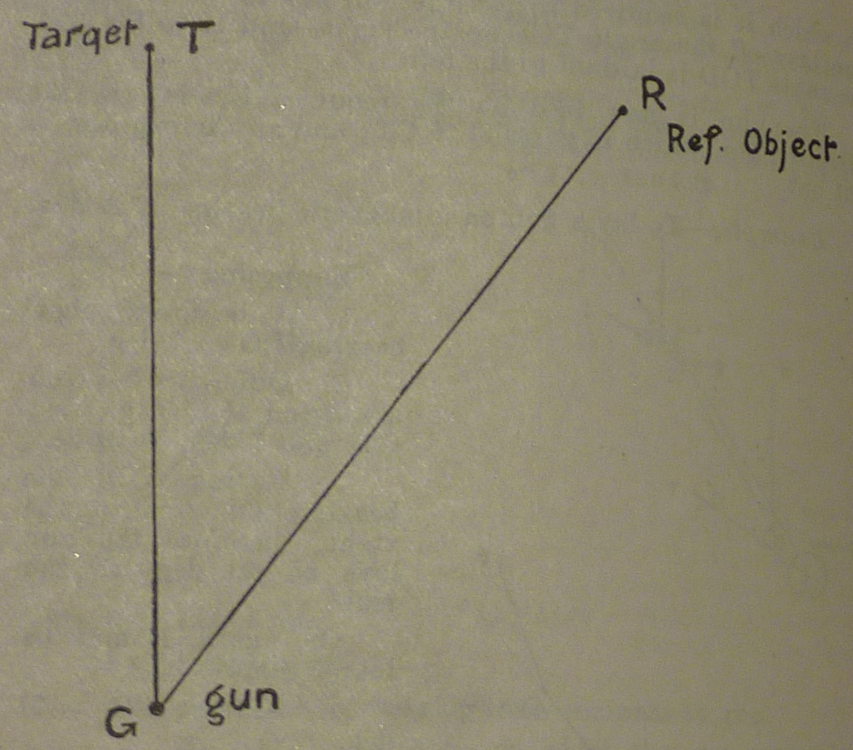
Method 2. By map and reference object.

(i.) The position of gun on the ground must first be accurately fixed on the map. (*See* Sec. 2, para. 2.)

(ii.) A reference object, which is both marked on the map and visible from the gun, is next selected. A line is drawn on the map.

(*a*) from the gun position to the target—G.T.; and

(*b*) from the gun position to the R.O. —G.R.



The angle TGR is now measured with a protractor. The gun lays on the R.O. and taps off the angle TGR, and an aiming post is put out in the direction obtained. The gun is now aligned on the target.

NOTE 1.—The angle TGR may be measured with a protractor without drawing any lines—but these are an aid to accuracy.

NOTE 2.—Where the position of the gun can be found from the detail on the ground, all errors arising from the use of the compass are avoided.

Method 3. By map, reference object, and compass.

A modification of Method 2 is necessary where no suitable reference object exists which is marked on the map and is visible from the gun.

Select a reference object on the ground, or, if necessary, place one out. Take the compass bearing from the gun position to the reference object.

Find from the map the bearing on which it is required to fire the gun. Find the difference between these bearings and lay off the angle obtained from the reference object.

NOTE.—*Effect of atmospheric conditions on direction.*

After the gun has been laid for direction by any of the methods given above, it is necessary to make the correction for wind. To find the allowance *see* Sec. 5, para. 3.

This allowance is put on the gun either by tapping off the required angle on the "T" shaped aiming post or by using the bar foresight.

B. *To obtain elevation.*

(i.) *On the map*, measure the range from the gun to the target and note:—

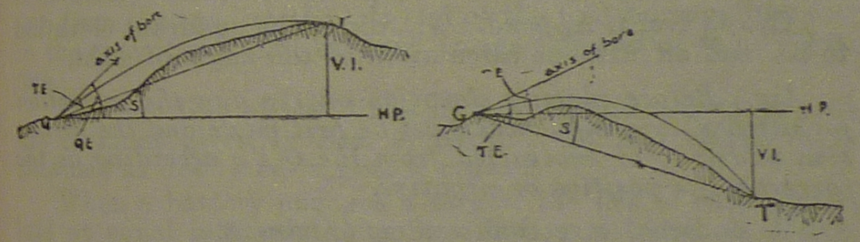
(*a*) The gun contour.

(*b*) The target contour.

The difference between the gun contour and the target contour is the vertical interval (V.I.).

(ii.) The quadrant elevation is now found by the formula:—

Q.E. = T.E. $\pm$ S. (*See* Sec. 5, para. 1.)



To obtain the angle of sight use the formula:—

$$\text{Angle of sight in minutes} = S = \frac{\text{V.I.}}{\text{H.E.}} \times 3400,$$

where V.I. = Vertical interval,
H.E. = Range,

and both are measured in the same unit.

In France, where the vertical intervals are in metres and the ranges in yards, the following may be used:—

$$S \text{ (in minutes)} = \frac{\text{V.I. (metres)}}{\text{H.E. (yards)}} \times 3750.$$

Example:—

Range = 1,700 yards and T.E. for 1,700 = 177′.
Gun contour = 20 yards.
Target contour = 50 yards. Therefore V.I. = 30.

$$S = \frac{30}{1700} \times 3400 = 60'.$$

QE = TE + S
= 177 + 60 = 237′,
or again if range = 1,700 yards,
Gun contour = 50 yards,
Target contour = 20 yards,

$$S = \frac{30}{1700} \times 3400 = 60'$$

QE = TE − S
= 177′ − 60′
= 177′.

(iii.) In order to save calculating the angle of sight and combining it with the tangent elevation to find the quadrant elevation, Tables 3A and 3B (Appendix IV.) have been compiled.

(These tables are compiled from the formula:—

$$S = \frac{V.I.}{H.E.} \times 3438:$$

the factor 3438 being more accurate than 3400, which gives an error of 1.2 per cent.)

Graph No. 1, Appendix V., allows the quadrant elevation to be read off without calculation of the angle of sight.

(iv.) *Before placing elevation on the gun the correction for atmospheric influences must be first made and the correction added to or subtracted from the Q.E., according as the correction is positive or negative.*

To find the correction *see* Sec. 5, para. 3.

(v.) *To put the elevation on the gun.*

Elevation is put on the gun with the clinometer:—

(*See* Appendix XI.: Adjustment of clinometers).

1. Set the clinometer to the required reading.

2. *Without holding*, place the clinometer on the tangent sight bed and elevate or depress the gun until the bubble is central. Move up the tangent sight slide until the point of aim is on the auxiliary aiming mark.

3. Take the holding and relay on the auxiliary aiming mark, using the elevating wheel, and *not* moving the tangent sight slide.

NOTE.—This method obviates the error arising from a difference in holding when putting on elevation and when firing.

10.—INDIRECT FIRE OF GUNS CONTROLLED IN BATTERIES.*

Laying and fire control where 1/20000 or larger scale contoured map is available.

(To be read in conjunction with Barrage Drill, Sec. 17, para. 7.)

1. All the guns of one battery are laid on parallel lines of fire initially, and zero aiming posts are placed in position. These lines are called the zero lines of fire of the battery, and form the basis from which the line of fire of each gun is taken. The methods of obtaining parallel lines of fire are explained in para. 4 of this Section, but where the nature of the ground admits, these lines should be checked by registration.

The guns are numbered from right to left, and the position of one gun is fixed as accurately as possible on the map. This gun is known as the directing gun, and is generally the left gun, to facilitate control The choice of the zero line is arbitrary, but if the left gun is directing, it is generally the line from that gun to the left end of the first barrage line—or in the case of a S.O.S. barrage, to the left end of this S.O.S. line.

The zero line of the directing gun is laid out by any of the methods given in Sec. 9, para. 1, A, and elevation is obtained as described in Sec. 9, para. 2.

When a battery engages a target, the fire of each gun is laid at equal intervals along it. Each gun traverses 1 deg. either side of its line of fire, except:—

(i.) When concentrated fire is ordered.

(ii.) Where the concentration of guns is great, *i.e.*, one gun to between 30 and 40 yards of front, when the total traverse is 1 deg.

(iii.) Where the concentration of guns is thin, and a traverse of 1 deg. either side is insufficient to ensure that no gaps are left. In this case a traverse of twice the angle of distribution should be ordered.

* *See* note at end of Index.

This traverse prevents gaps by causing:—

(i.) The fire of neighbouring guns to overlap.

(ii.) The fire of neighbouring batteries to overlap.

At the same time, as the angle of traverse is small, different guns can have different quadrant elevations when the nature of the target demands it.

The fire is controlled by either—

(*a*) Shutter.

(*b*) Whistle.

The former has been found the more effective method.

2. DISTRIBUTION OF FIRE.

Where the frontage of the target as viewed from the battery, is greater than that of the battery, it is necessary to distribute the fire of the battery from their parallel lines, in order to lay the fire of each gun at equal intervals along the target.

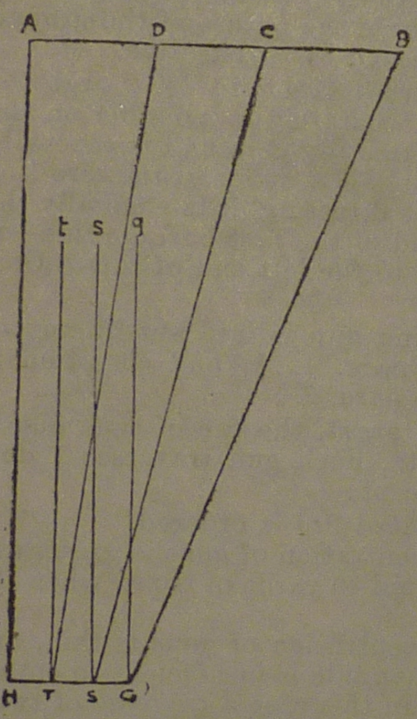


Fig. I. (not to scale).

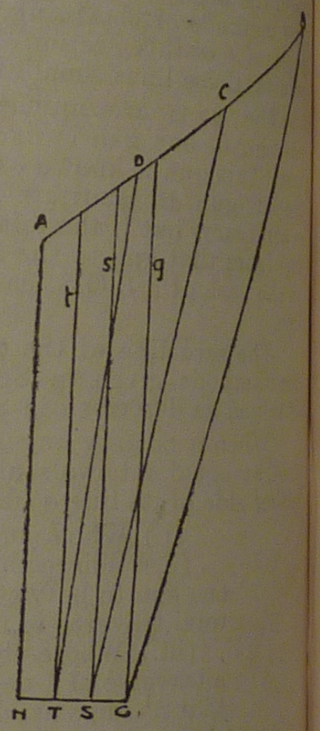


Fig. II. (not to scale).

These figures shew the lines of fire of a 4-gun battery:—

(*a*) On their parallel zero lines.

(*b*) After distribution of fire along:—

(i.) A frontal target.

(ii.) An oblique target.

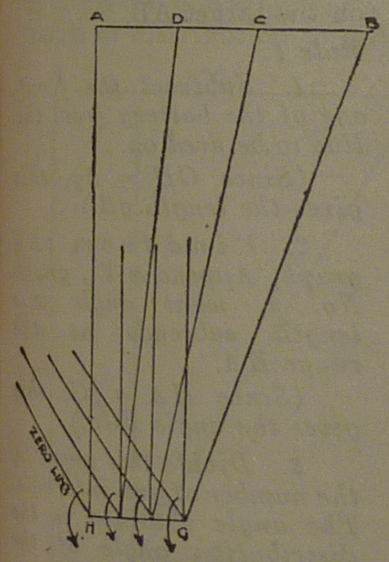
The angle DT't is the *angle of distribution of the battery for the target AB.*

The angle CSs = twice the angle DTt.
The angle BGg = three times the angle DTt.

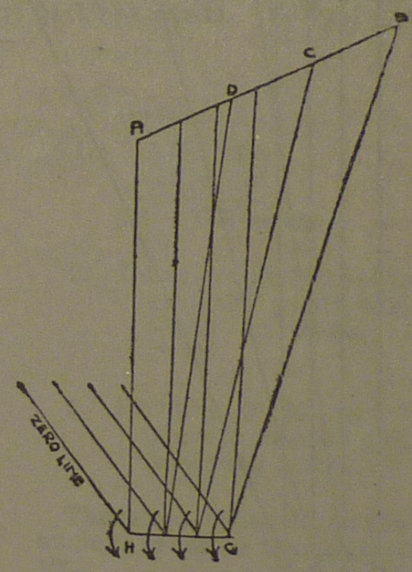
Example:—If angle DTt = 1°
angle CSs = 2°
angle BGg = 3°

Measurements of this angle are taken to the nearest 10 min.

If the zero line of the left gun (*i.e.*, directing gun), is not directed on the left end of the target, this gun is switched through an angle so as to direct its fire on to the left end of the target. This angle is called the "switch angle," and before distribution of fire along the target, all guns are ordered to lay off this angle from their zero lines. This angle is measured by a protractor, or read from the fighting map.



Angle of switch.
Fig. III. (not to scale).



Angle of switch.
Fig. IV. (not to scale).

These figures shew the lines of fire of a 4-gun battery:—

(*a*) On their parallel zero lines.

(*b*) After all guns lay off the "angle of switch" from their zero lines.

(The guns are still on parallel lines of fire.)

(*c*) After distribution of fire along:—

(i.) A frontal target.

(ii.) An oblique target.

To obtain the distribution angle.

Case I.

Frontal barrage.—Where the angle HAB is between 80 deg. and 100 deg.

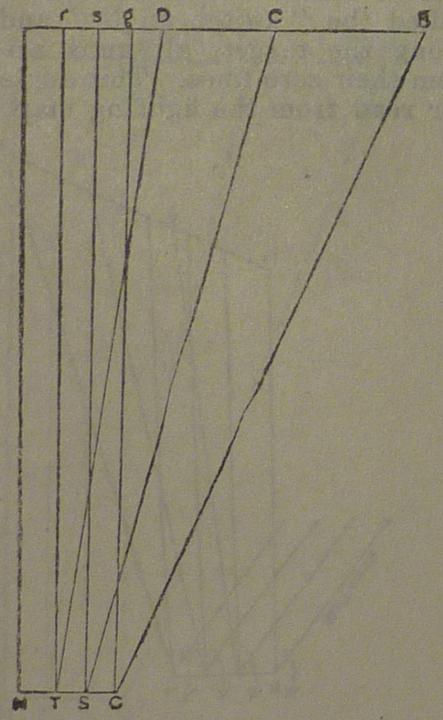


Fig. V. (not to scale).

The figure shews the guns of a 4-gun battery.

(*a*) On parallel lines before distribution.

(*b*) After distribution on the target AB.

Rule I.

1. Subtract the frontage of the battery from the line to be fired on.

(*Since GH = Ag, this gives the length gB.*)

2. Find from the graph, Appendix V., graph No. 2, what angle this length subtends at the range HA.

(*Since HA = gG, this gives the angle BGg.*)

3. Divide this angle by the number of gun intervals. The angle obtained is the distribution angle of the Battery.

(See *para. 2 above.*)

If no graph is available the angle BGg can be obtained:—

(i.) By using the "angle of sight" formula.

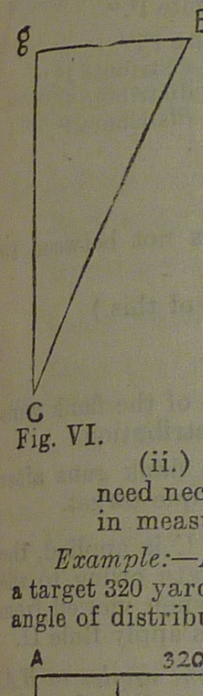


Fig. VI.

$$\frac{\text{V.I.}}{\text{H.E.}} \times 3400 = \text{angle in minutes.}$$

Where V.I. = AB − GH = gB.

H.E. = Range HA = gG.

NOTE.—This formula should not be used if the angle BGg exceeds 10 deg.

(ii.) By measurement with a protractor. *No* lines need necessarily be drawn, but errors are easily made in measuring the angle BGg.

Example:—A battery of 8 guns, 10 yards apart, engages a target 320 yards long at a range of 2,100 yards. To find the angle of distribution to order:—

Fig. VII. (Not to scale.)

Applying Rule I.

1. AB = 320
   GH = 70
   AB − GH = 250

2. Using graph, 250 yards at 2,100 yards subtends an angle of 6° 50′.

3. Dividing 6° 50′ by 7 (since there are 7 gun intervals) = 59′.

Therefore, order 1°, as the angle is taken to the nearest 10′.

NOTE.—(i.) As the angle HAB is between 80° and 100°, this is a frontal barrage.

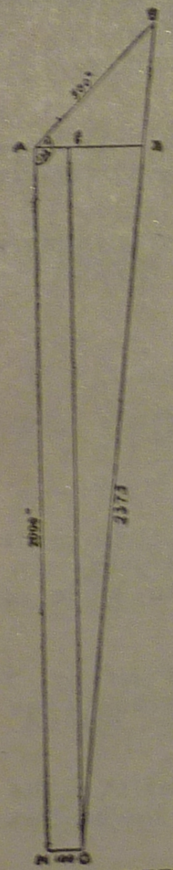
(ii.) On the order being given:—"Distribute 1°."

No. 1 of No. 8 gun repeats "Distribute 1°."
No. 1 of No. 7 ,, ,, "1° right, distribute 1°."
No. 1 of No. 6 ,, ,, "2° right, distribute 1°."
No. 1 of No. 5 ,, ,, "3° right, distribute 1°."
etc. (*See* Barrage Drill, Third stage.)

Case II.

Oblique barrage.—Where angle HAB is not between 80 deg. and 100 deg.

(NOTE.—Enfilade barrage is only a type of this.)



(Fig. VIII. to scale).

The figure shows:—

(*a*) The parallel lines of fire of the flank guns of a battery before distribution.

(*b*) The lines of fire of the flank guns after distribution on an oblique target.

It is obvious that if Rule I. is applied, the distribution would be inaccurate owing to the foreshortening of the target when viewed from the battery. To overcome this apply Rule II.

Rule II. Draw AX at right angles to HA. This is called the "working base," and is used instead of AB to determine the angle of distribution.

To find AX:—

(*a*) *Measure it from the map by drawing, or,*

(*b*) *Without drawing, use graph No. 2, Appendix V. to find AX.*

(*c*) *Proceed now as in Rule I., using AX instead of AB from which to subtract the battery frontage.*

NOTE.—As the ranges HA and GB are different, combined sights are used.

Example:—An 8-gun battery on a front of 100 yards, engages a target 500 yards long, where the angle HAB = 135 deg. and the range HA = 2,000 yards. (*See* Fig. VIII.)

To find the angle of distribution.—Apply Rule II.

By drawing, the working base AX = 320 yards.

By calculation:—

Using graph No. 2.

Since the angle HAB = 135°, then from the scale for converting oblique to equivalent frontal targets

$$AX = \cdot 64 \times AB$$
$$= \cdot 64 \times 500$$
$$= 320 \text{ yards.}$$

Proceeding now as in Rule I. and using AX instead of AB,

(i.) AX = 320
GH = 100
$\therefore$ AX − GH = 220.

(ii.) 220 yards and 2,000 yards subtends 380'

(iii.) dividing 380' by 7 (as there are 7 gun intervals) = 54'
i.e. Order "Distribute 50',"

To find elevation.

Range GB = 2,375. QE = 390'
Range HA = 2,000. QE = 256'

Therefore, difference = 134'.
Dividing by 7 (*i.e.*, the number of gun intervals)
Result = 19'.
Take 20', being to the nearest 10', and order "Elevation 4° 20', 20' differences."

3. CONCENTRATION OF FIRE.

Where the frontage of the target as viewed from the battery is less than that of the battery, it is necessary to

concentrate the fire of the battery from their parallel lines.

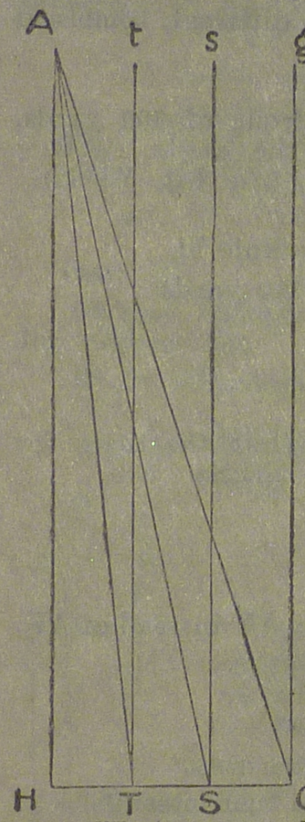


Fig. IX. (not to scale).

This figure shows the lines of fire of a 4-gun battery.

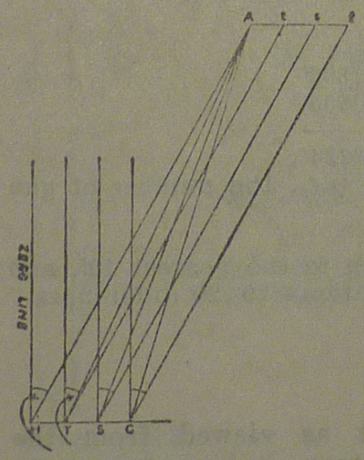
(*a*) On their zero lines.

(*b*) After concentration on the target A.

The angle tTA is the angle of concentration of the battery for the target A.

The angle sSA = twice the angle tTA.

The angle gGA = three times the angle tTA.



Angle of switch.

Fig. X. (not to scale).

This figure shows the lines of a 4-gun battery.

(*a*) On their zero lines.

(*b*) After all guns lay off the "angle of switch" from their zero lines.

(*See* para. 2, Figs. III. and IV.)

(*c*) After concentration on to the target A.

The angle tTA is the angle of concentration of the battery for the target A.

The angle sSA = twice the angle tTA.

The angle gGA = three times the angle tTA.

To find the angle of concentration.

Rule III.

Subtract the frontage of the target from the frontage of the battery, and proceed exactly as in Rule I., but substitute concentration for distribution.

Example:—A battery of 8 guns on a frontage of 120 yards desires to engage a target whose frontage is 40 yards, at a range of 2,100 yards. To find the angle of concentration.

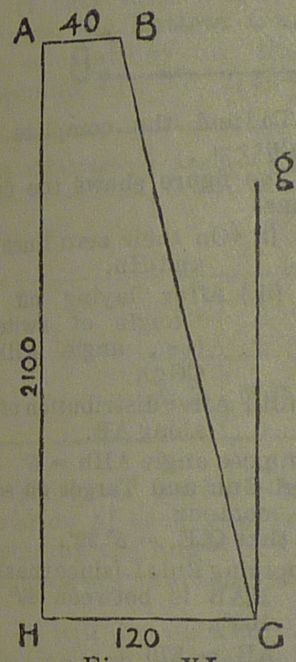


Figure XI.

(i.) GH = 120 yards
AB = 40
GH − AB = 80

(ii.) 80 yds. at 2,100 subtends an angle of 2° 15′

(iii.) Dividing by 7,
Result = 19′.

Order 20′ as angle of concentration.

NOTE 1.—On order being given, "Concentrate 20 min.,"

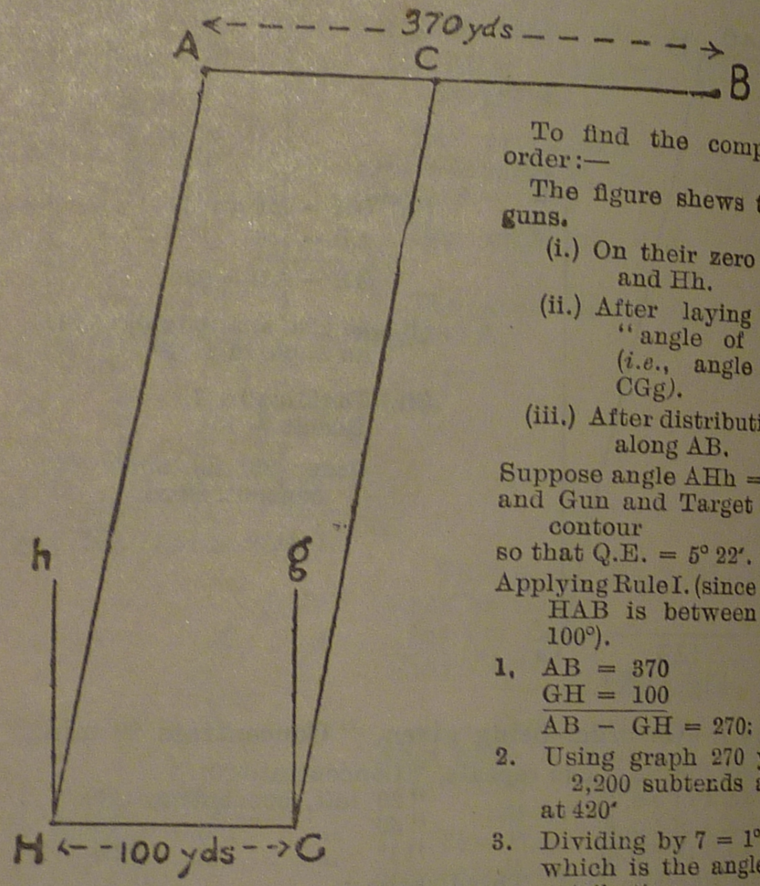
No. 1 of No. 8 gun repeats, "Concentrate 20′."
No. 1 of No. 7 ,, "20′ left, concentrate 20′,"
No. 1 of No. 6 ,, "40′ ,, ,, 20′,"
No. 1 of No. 5 ,, "1° ,, ,, 20′,"
etc. (*See* Barrage Drill, Third stage.)

NOTE 2.—It will often be found that for flank barrages the working base, as found by the use of Rule II., will be less than the battery front, and it will then be necessary to use Rule III., and concentrate the fire.

NOTE 3.—*It will generally be sufficient, in order to engage a target such as an enemy concentration, to switch the fire of the battery on parallel lines without concentration or distribution of fire.*

Example:—Shewing distribution of fire along a target, after a switch.

A battery of eight guns on a frontage of 100 yards is ordered to engage a target 370 yards long at 2,200 yards range.



To find the complete fire order:—

The figure shews the flank guns.

(i.) On their zero lines Gg and Hh.

(ii.) After laying off the "angle of switch" (*i.e.*, angle AHh = CGg).

(iii.) After distribution of fire along AB.

Suppose angle AHh = 5°
and Gun and Target on same contour
so that Q.E. = 5° 22′.

Applying Rule I. (since the angle HAB is between 80° and 100°).

1. AB = 370
   GH = 100
   AB − GH = 270:
2. Using graph 270 yards at 2,200 subtends an angle at 420′
3. Dividing by 7 = 1°
   which is the angle of distribution.

The complete orders by the Battery Commander would be:—

Stand to.
All guns on zero.

All guns 5 deg. right.
No. 8 gun directs.
Distribute 1 deg.
Load.
Elevation 5 deg. 22 min.
Medium rate (or whatever rate is ordered).
Fire.

If this target formed part of a previously arranged barrage, the Battery Commander would place the results of his calculations in the Battery Chart as follows (*see* Appendix VI., No. 2):—

No. of Barrage.	Angle of Switch.	Distribution angle.	Range.	V.I.	Q.E.
A.	5° R.	1°	2,200	0	5° 22′

A.	8	7	6	5	4	3	2	1
	5° R	6° R	7° R	8° R	9° R	10° R	11° R	12° R

The lower part of the Battery Chart shows the *angle of deviation* of each gun from its zero line. This is found by combining the angle of switch with the distribution angle or the necessary multiple of the distribution angle.

It will be noticed that the angle of deviation of the directing gun equals the angle of switch.

From this part of the table the gun charts are compiled.

NOTE.—(i.) Where the situation does not permit the passing of orders, the Battery Commander will employ the most suitable means of conveying the fire orders to his guns, *e.g.*, by giving orders himself to each gun Commander in turn, or sending the orders by runner to the gun Commanders.

NOTE.—Appendix VI., No. 2 and No. 3, should be read before proceeding to Section 10, para. 4.

Frontage of battery.
Definition.

The frontage of a battery is the perpendicular distance between the parallel lines of the flank guns.

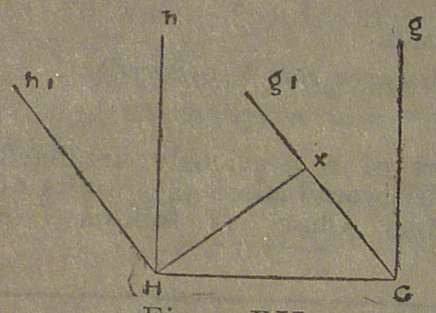


Figure XII.

The figure shows:—

1. Zero lines of flank guns of a battery, Hh and Gg.

As the angle hHG = 90 deg., the frontage of the battery = GH.

2. Parallel lines Hh_1 and Gg_1 after a switch.

The frontage of the battery is now HX, *not* GH.

This is only equal to the distance between the guns when the angle (hHG) between the line of fire of the directing gun and the line of guns is a right angle.

The error arising from considering the battery frontage as the distance between the guns may be always neglected where the angle hHG is between 110 deg. and 70 deg.

In other cases greater accuracy will be ensured if the frontage HX is used rather than the distance between the guns GH.

To obtain HX:—

(*a*) Measure it on the map,

or (*b*) Use graph No. 2, Appendix V. (*See* above, Case II., Oblique Barrage.)

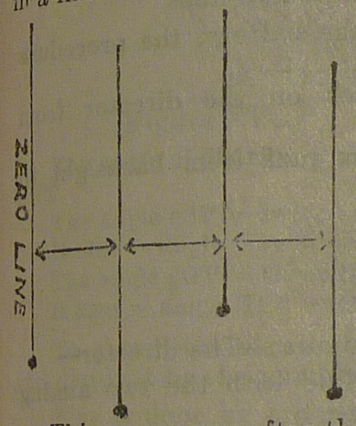
4. TO OBTAIN PARALLEL LINES OF FIRE.

(*a*) *It is very important that the lines of fire of the guns of a battery should be parallel when first laid out, and every effort should be made to attain this object.* The battery commander will then have a definite condition from which to make his calculations, and can switch his guns from one target to another without losing parallelism, distribute his fire correctly over a given front, or concentrate it on a given point, by means of the methods given above in para. 2 and para. 3. Any of the methods given below may be used, and the battery commander will choose that most suited to the situation. In general, the method depending on the distant R.O. is the quickest and most accurate, the compass the slowest and most inaccurate.

(*b*) *Methods depending on use of compass.*

Each gun is laid on the same bearing by compass. This bearing is the bearing of the zero line. The methods can be any of those given in Sec. 9.

The lines of a battery may be laid by compass when the ground renders it impossible to place the guns approximately in a line and there is no R.O. at a great distance.



The figure shows a four-gun battery in shell holes with parallel zero lines of fire.

Figure XIII.

This may occur after the forward move of batteries to new shell hole positions, from which to create a S.O.S. barrage line. When firing in this direction the gun intervals should be as nearly equal as possible.

(*c*) *Methods depending on the use of a director or a gun used as a director.*

The zero line of the directing gun is laid out by any of the methods described in Sec. 9 and is marked by two posts.

The director is now placed in line with the two aiming posts at least 50 yards in front or rear of the battery, with the foresight towards the target and clamped at zero.

If a gun is being used the reading on the traversing dial is noted

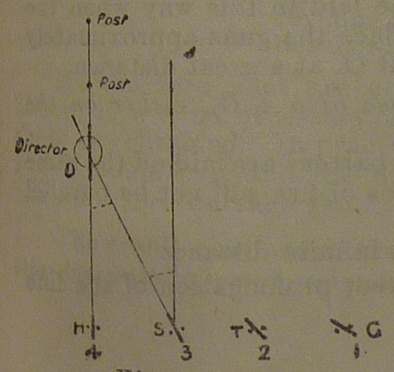


Figure XIV.

The figure shows: — The director—

(i.) In line with the two aiming posts;

(ii.) Laid back on No. 4 gun;

(iii.) Laid back on No. 3 gun;

(iv.) No. 3 gun lays off the angle sSD = angle HDS, and is now on its zero line.

All guns now lay on the director.

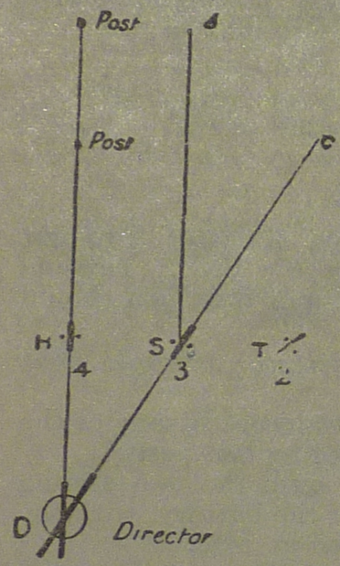
The controlling officer now faces the battery and lays back over the director (*foresight* over *backsight*) on to each gun in turn.

The angles swung through are noted and given to the guns. Each gun lays off the angle given to it, and an aiming post is put out. The guns are now in parallel zero lines.

Where the director is behind the battery, the procedure is the same, except:—

(i.) Guns are laid back on the director from *foresight* to *backsight*.

(ii.) Director is laid on guns from backsight to foresight.



The figure shows:—The director—

(i.) In line with the two aiming posts;

(ii.) Laid forward on No. 3 gun;

(iii.) No. 3 gun laid back on the director;

(iv.) No. 3 gun lays off the angle sSC = angle HDS, and is now on its zero line.

Figure XV.

The lines of a battery may be laid in this way when the ground renders it impossible to place the guns approximately in a straight line and there is no R.O. at a great distance.

(*d*) *Methods depending on the use of a R.O., either on the map or put out.*

When all the guns of the same battery are laid off the same angle from the same R.O., the lines of fire will not be parallel unless:—

(i.) The R.O. is at an infinite distance.

(ii.) The R.O. is in direct prolongation of the line of the guns.

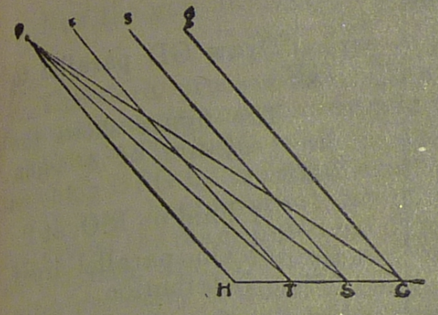


Figure XVI.

The figure shews the guns of a 4-gun battery:—

(*a*) Laid on the R.O. at P.

(*b*) After distribution to obtain parallelism.

The angle of distribution for the battery = angle tTP = angle HPT.

The angle sSP = twice angle tTP.
It also = angle HPs = twice angle HPT.
The angle gGP = three times angle tTP.
It also = angle HPG = three times angle HPT.

To obtain the distribution angle, measure the angle HPG and divide it by the number of gun intervals.

This is done by ordering flank guns to lay on each other and on R.O.; each gun notes the angle swung through. This measures angle PHG and PGH.

Add these angles together and subtract their sum from 180 deg. The result is angle HPG. Divide this angle by the number of gun intervals and this is the angle of distribution to obtain parallelism.

NOTE.—The three angles of a triangle added together = 180 deg.

Example.—Angle PHG = 120°
Angle PGH = 57°
adding = 177°
180° − 177° = 3°
Dividing by number of gun intervals (3)
Result = 1°.

As the zero lines are unlikely to be the lines obtained above, it will be necessary to switch the parallel lines once these are obtained. In practice it is found better to order the switch angle first and the distribution angle for parallelism second. (*See* Barrage Drill, Stage 2.)

The result obtained is the same and the angle of distribution for parallelism is independent of the switch angle.

Case I.—R.O. in front of guns.

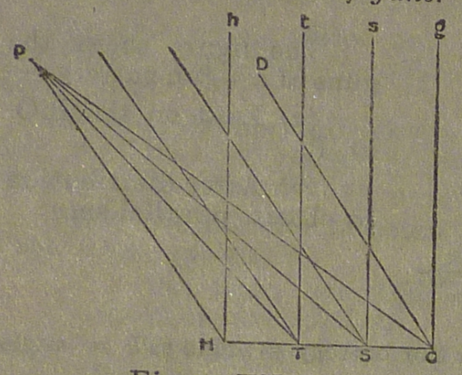


Figure XVII.

Draw GD parallel to HP.

The figure shews the lines of fire of a 4-gun battery.

(*a*) Laid on R.O. at P.

(*b*) On parallel lines after distribution.

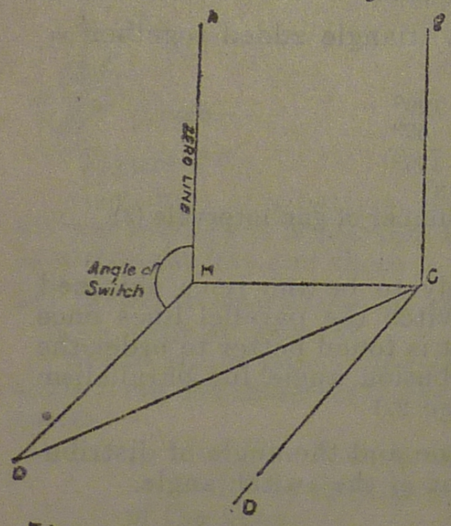
(*c*) On parallel zero lines.

Then in order for the gun at G to fire on its zero line Gg, it must lay off the angle gGP = angle gGD plus angle DGP
= angle hHP plus angle HPG
= switch angle plus angle HPG.

Therefore, measure angle HPG as described above and divide this angle by the number of gun intervals. This is the angle of distribution for the battery.

Example:—If switch angle = 60°,
Angle of distribution = 1°.
Order—All guns on R.O.
All guns 60° right,
No. 4 gun directs,
Distribute 1°.

Case II.—R.O. behind guns.



The figure shows the flank guns of a battery:—

(*a*) Laid on R.O.;

(*b*) On parallel zero lines.

Draw GD parallel to HP. Since Hh and Gg are parallel, and HP and GD are parallel, therefore angle hHP = angle gGD, and angle HPG = angle PGD.

Figure XVIII.

Now the gun at G lays off the angle gGP
= angle gGD − angle PGD
= angle hHP − angle HPG.

Therefore, proceed as in Case I., order all guns to lay off the switch angle and *concentrate* instead of distribute.

NOTE.—The angle of concentration is obtained by dividing the angle HPG by the number of gun intervals.

It may happen that no suitable R.O. exists which is marked on the map, but some object may be used which is not on the map, and by taking a bearing to this the angle of switch necessary to obtain the zero line can be obtained.

This object can then be used to obtain parallelism as described above.

The R.O. must be as far away as possible, and it is sufficient if the guns are approximately in line.

If there is no suitable R.O. one must be put out in the line of the guns at a distance of at least 400 yards if possible; and the guns should be in line as accurately as possible.

Here the bearing to the R.O. is taken from position of the directing gun.

It may happen that the R.O. is invisible from one of the gun positions or that the gun is out of line.

In this case its line can be laid:—

(*a*) By compass;

(*b*) By laying on any gun which has obtained its zero line.

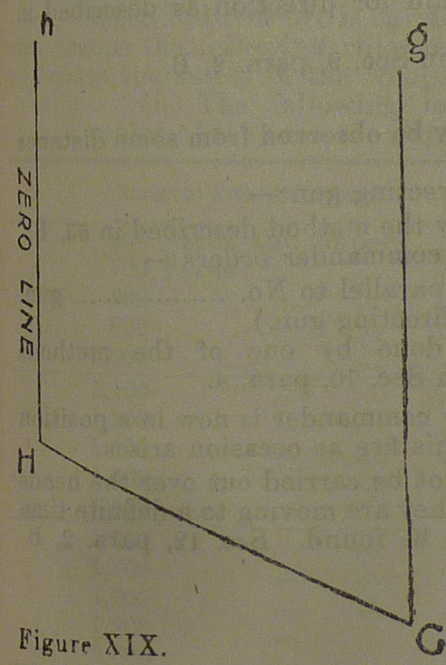


Figure XIX.

The figure shews Hh the zero line of a gun already obtained, Gg the zero line of a gun obtained as follows:—

The guns lay on each other.

The gun at H records the angle hHG.

The gun at G subtracts this from 180 deg., and lays off the result from the gun at H. It is now on the parallel line Gg.

NOTE.—Since Hh and Gg are parallel, angle hHG plus angle gGH =180 deg.

5. INDIRECT FIRE BY MACHINE GUN BATTERIES WHERE A 1/20,000 OR LARGER SCALE MAP IS NOT AVAILABLE.

In order to deal with the tactical situation discussed in Section 40, Part I. (Open Warfare), provision must be made in the training of Machine Gun Units for applying the indirect fire of batteries without the use of contoured maps.

The principles of distribution and concentration of fire from parallel lines and the methods of obtaining parallel lines remain unchanged, but modifications are required in the method of laying out the zero line of the directing gun and obtaining its elevation.

In the following the word "director" will be taken to mean either a "director" proper or some means of improvising a director, *e.g.*, a machine gun, a compass in conjunction with an angle of sight instrument, or a sextant.

Two cases now arise:—

Case I.

Where the target can be seen from the vicinity of the battery position.

The line to the target is marked by two aiming posts.

The director is then placed in line with the two aiming posts at least 50 yards in front of, or rear of, the line of the battery, and the guns are laid for direction as described in Sec. 10, 4, c.

Elevation is obtained as in Sec. 9, para. 2, B.

Case II.

Where the target can only be observed from some distance to a flank.

The line of fire of the directing gun:—

(i.) Is laid out by the method described in 53, B.

(ii.) The battery commander orders:—

All guns parallel to No. ..... gun.
(This being directing gun.)

This is done by one of the methods described in Sec. 10, para. 4.

In either case the battery commander is now in a position to distribute or concentrate his fire as occasion arises.

This type of fire should not be carried out over the heads of troops in the open, unless they are moving to a definite time table, and the clearances can be found. Sec. 12, para. 2, B.

11.—MAINTAINING LAYING.

After a gun has been laid for direction and elevation by any of the means described in Secs. 9 and 10, an aiming post is put out in order to maintain direction and elevation. The tangent sight slide is run up until the sights are aligned on the bull on the aiming post, and the laying is maintained by relaying on the bull between bursts. In addition, the elevation should be frequently checked by the clinometer. Appendix X. describes two types of aiming posts in use.

Inaccurate laying on the auxiliary aiming mark can only be avoided by training the personnel. Too much stress cannot be laid on this part of the machine gunner's training, as failure to realise the importance of accurate aiming may lead to fire becoming dangerous to our own troops, and a consequent loss of confidence by the infantry.

Machine gunners should be tested in aiming from time to time by the "triangle of error" method.

NOTE.—Where no form of artificial aiming mark is available, some natural object on the ground may be selected. This should only be regarded as a makeshift, and not taught as a general practice.

12.—SAFETY CLEARANCES.

The clearance at any point over which fire is being directed is the vertical distance of the centre of the cone above that point.

1. When indirect fire is carried out over the heads of our own troops the following rules must be adhered to in order to ensure the safety of the troops:—

(i.) The following minimum clearances of the centre of the cone are required:—

Range to Friendly Troops	Minimum Clearance	
	Yards	Metres
600 yards and under ...	11	10
700 yards	13	12
800	15	14
900	17	16
1,000	20	18
1,100	23	21
1,200	27	25
1,300	31	28
1,400	35	32
1,500	40	37
1,600	46	42
1,700	53	48
1,800	60	55
1,900	69	63
2,000	80	73

(ii.) Our own troops must not be more than 2,000 yards from the guns.

(iii.) Steps must be taken to prevent such extremes of traversing and searching as would violate (i.). This is best done by using traversing and elevating stops.

(iv.) Calculations must be carefully checked and atmospheric conditions allowed for.

(v.) The rigidity of the firing platform is essential. This is obtained by the use of the "T" base.

(vi.) Elevation must be frequently checked by the clinometer.

(vii.) The personnel must be highly trained in accurate aiming and relaying.

(viii.) The maps used must be accurate and the scale not smaller than 1/20,000.

(ix.) Worn barrels and tripods should not be used.

(x.) Our own troops should be warned when firing is going to take place.

(xi.) Clinometers should be frequently tested.

The following table shows the various causes which may result in fire becoming dangerous, and how these causes may be avoided:—

Cause	How avoided
(i.) Worn barrels.	Replacement by new barrels, but the life of a barrel is increased by care in oiling and pulling through.
(ii.) Worn mountings.	Replacement by new tripods or by the use of washers.
(iii.) Bad holding.	Training of personnel.
(iv.) Bad laying on auxiliary aiming mark.	Training of personnel.
(v.) Extremes of traversing and searching.	Training of personnel and use of traversing and depression stops.
(vi.) Error in calculation.	Practice in the use of the Tables and Graph.
(vii.) Failure to allow for atmospheric conditions.	
(viii.) Inaccurate Clinometer.	Constant testing.
(ix.) Mounting sinking.	Use of "T" bases and care in construction of firing platforms.

The importance of the rigid platform may be better realised if it is remembered that a change of elevation of 30 min. is caused if the front legs sink 1/3rd inch while the rear legs remain fixed, and *vice versa* if the rear legs sink while the front legs remain fixed. As this error is neutralized by relaying on an auxiliary aiming mark, the necessity for constant and accurate relaying is again emphasized.

NOTE.—The safety clearances are based on:—

(i.) A possibility of 5 per cent. error in range on the map.

(ii.) A possibility of 10 per cent. error in range, due to worn barrel, bad holding, etc.

(iii.) A possible error of 40 min. in the play of the tripod.

(iv.) Allowance for the lowest shot of the cone.

2. (A) To find the clearance over the friendly troops, using Tables 2 (A) or 2 (B) (Appendix IV.).

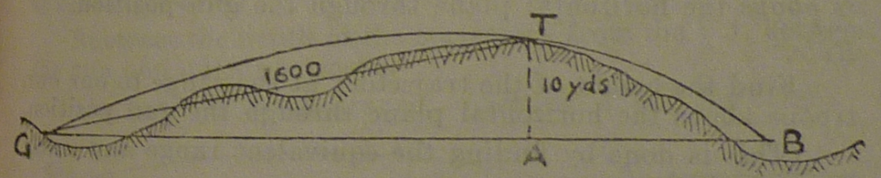
Definition of equivalent range.

The range at which the centre of the cone would strike the horizontal plane through the gun position.

It is found by using Table 1, Columns 1 and 2, and is used to determine the heights of the trajectories above the horizontal plane by means of Table 2 (A).

NOTE.—There is no equivalent range if the Q.E. is negative.

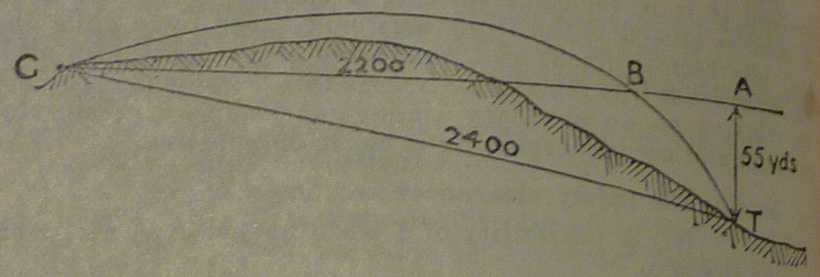
Example 1. Target above gun.



The figure shows the trajectory to hit the target at T and GB, the equivalent range on the horizontal plane through the gun position.

If GT = 1,600 yards
and target is 10 yards *above* gun.
Table 3 (A) gives QE = 177'.
Table 1, Columns 1 and 2 shew equivalent range = 1,700
i.e., GB = 1,700.

Example 2.



Target below gun.

The figure shows the trajectory to hit the target at T and GB, the equivalent range on the horizontal plane through the gun position.

If GT = 2400 yards
and target is 55 yards *below* gun
Table 3 (B) gives Q.E. = 322′
Table 1, Columns 1 and 2 shew equivalent range = 2200
i.e., GB = 2200.

Procedure to find clearance.

Determine Q.E. and, when possible, the equivalent range.
Note the gun contour.
Note the friendly troops contour.
And so obtain the V.I. between the gun and our own troops.

The following two cases may arise:—

Case I.

Where the trajectory, as it passes over our own troops, is *above* the horizontal plane through the gun position.

Rule.

Find the height of the trajectory at the range to our own troops above the horizontal plane through the gun position.

(This is done by finding the equivalent range and using Table 2 (A).)

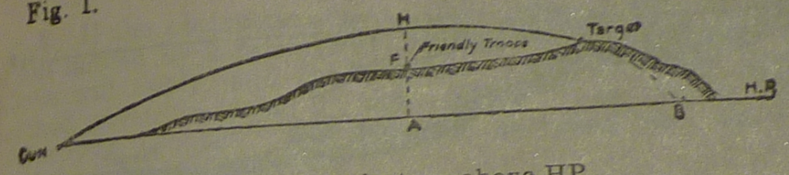
If the friendly troops are above the gun, *subtract* the V.I. between the gun and our own troops from the trajectory height.

The result is the clearance. (*See* Fig. I.)

If our own troops are below the gun, *add* the V.I. to the trajectory height.

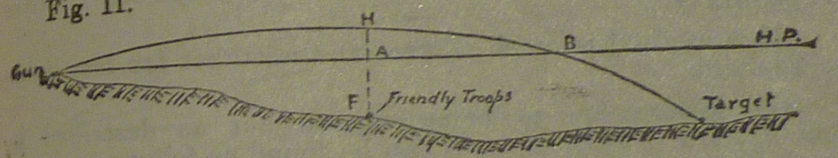
The result is the clearance. (*See* Fig. II.)

Fig. I.



HA = height of trajectory above HP.
FA = V.I. between our own troops and gun.
Clearance = HA − FA.
= HA − VI.

Fig. II.



HA = height of trajectory above HP.
FA = V.I. between our own troops and gun.
Clearance = HA + FA.
= HA + VI.

Case II.

Where the trajectory as it passes over our own troops is *below* the horizontal plane through the gun position.

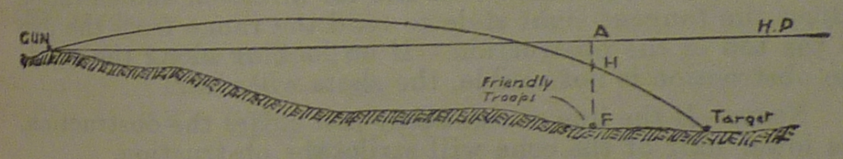
Rule.

Find the depth of the trajectory at the range to our own troops below the horizontal plane through the gun position.

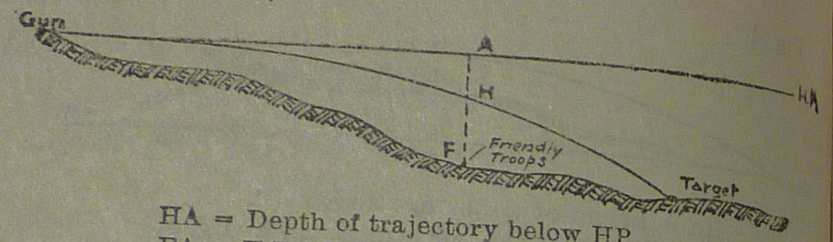
(This is done by finding the equivalent range and using Table 2 (A) if the Q.E. is positive, by using Table 2 (B) if the Q.E. is negative.)

Subtract the depth of the trajectory from the V.I. between the gun and our own troops.

The result is the clearance. (*See* Fig. I. and Fig. II.)



HA = Depth of trajectory below HP.
FA = V.I. between our own troops and guns.
Clearance = V.I. − HA.



HA = Depth of trajectory below HP.
FA = V.I. between our own troops and guns.
Clearance = V.I. – HA.

Clearances may also be found by using graph No. 1. (*See* Appendix V.)

This method is much shorter and mistakes are less liable to be made.

(B) Where fire is being carried out as described in Sec. 9, para. 2 B, clearances can be found as follows:—

(i.) Determine the range to our own troops and the angle of sight from the gun to our own troops in exactly the same manner as determining the range to the target and the angle of sight to the target.

(ii.) Obtain the V.I. between the gun and our own troops from the formula:—

$$\text{V.I.} = \frac{(\text{Angle of sight from gun to our own troops}) \times (\text{Range from gun to our own troops})}{3{,}400.}$$

It is now simple to find the clearance proceeding, as described in 2 (A) above.

3. CLEARING THE OBSTRUCTION.

In all cases where an obstruction exists between the gun and the target, it is necessary to ensure that the shots will clear the obstruction before opening fire.

To do this:—

1. After the gun has been laid for direction and elevation adjust the tangent sight slide to read the range from the gun to the top of the obstruction. If on looking along the sights the obstruction is not visible, the shots will clear.

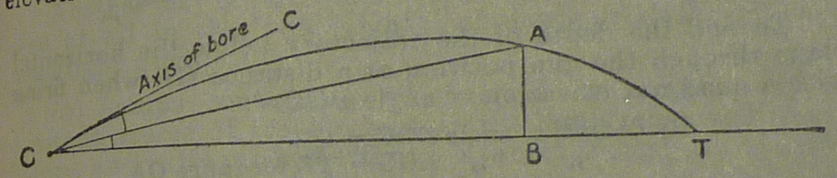
NOTE.—If the line of sight only just clears the obstruction, the lower half of the cone will strike the obstruction.

2. If the distance to the obstruction is under 100 yards put the sights at zero (the gun being already laid for direction and elevation); if, on looking along the sights the obstruction is not visible, the shots will clear.

3. If the obstruction is invisible (such as the summit of a hill hidden by a false crest) neither of the methods given above will apply, and the clearance must be found by the method given in para. 1, substituting "Obstruction" for "Our Own Troops." The clearance must be at least equal to half the height of the cone.

*4. TRAJECTORY TABLES.

Table 2 (A) is the trajectory table for positive quadrant elevations. It is compiled as follows:—



To find the height of the trajectory at a distance GB when firing at a range GT.

By definition angle TGC = TE for range GT, Sec. 49, para. 1, and assuming the rigidity of the trajectory,

By definition angle AGC = TE for range GA
= TE for range GB

(since GA = GB approximately the angle AGB being small).

But angle BGA = angle TGC – angle AGC
= TE for range GT – TE for range GB.

Now applying the angle of sight formula

$$S = \frac{VI}{HE} \times 3348 \text{ and so } VI = \frac{S \times HE}{3438}$$

and remembering S = angle BGA. Sec. 49, para. 3.

VI = AB
HE = GB

$$\text{the clearance AB} = \frac{(\text{TE for range GT} - \text{TE for range GB}) \times \text{GB}}{3438}$$

Example:—To find height of 1,700 yards trajectory at 1,000 yards.

TE for 1700 = 177
TE for 1000 = 62

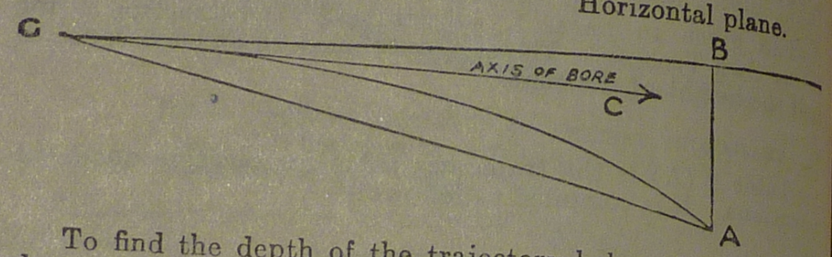
$$AB = \frac{(177 - 62) \times 1000}{3438}$$

$$= \frac{115 \times 1000}{3438}$$

= 33·4 yards.

Table 2 (A) gives 33·8.

Table 2 (B) is the trajectory table for negative quadrant elevations. It is compiled as follows:—



To find the depth of the trajectory below the horizontal plane through the gun position at a distance GB when firing with a quadrant elevation = angle BGC.

By definition angle BGC = QE
" " " AGC = TE for range GA
= TE for range GB
(since GA = GB approximately)
But angle BGA = angle BGC + angle AGC
Now applying the angle of slight formula

$$S = \frac{V.I.}{H.E.} \times 3438$$

and remembering S = angle BGA
V.I. = AB
H.E. = GB

$$\text{Then AB} = \frac{(\text{QE} + \text{TE for range GB}) \times \text{GB}}{3438}$$

Example:—Supposing a negative angle of Q.E. of 100 min.

To find depth of trajectory below horizontal plane at a distance of 1,000 yards.

Then TE for 1000 yards = 62'.

$$\text{AB} = \frac{(100' - 62') \times 1000}{3438}$$

= 47·1 yards.

Table 23 (B) gives 47·2.

In addition, all graphs and other aids to determine clearances without calculation are based on these Trajectory Tables.

13.—NIGHT FIRING.

1. When indirect fire is carried out by night, the gun position must be fixed by day, and a post at some known direction from the gun position must be placed in the ground

by day, or at dawn or dusk, as it is usually impossible to do these things with accuracy after dark. After dark, the post must be replaced by some illuminated aiming mark.

2. *Night Aiming Mark.*—(*a*) Experiments with aiming marks covered with luminous paint have not proved successful. Even on a dark night such aiming marks require very frequent exposure to artificial light in order to retain the necessary luminosity, and even then afford no *definite* point of aim.

Another objection is that such aiming marks cannot be seen at all in the "half-light" of dawn or dusk, or on a moonlight night.

(*b*) Lamps containing oil burners or candles are a constant source of trouble because the lamp must be lighted before, and extinguished after each target is engaged. If this is not done the mark becomes obscured by the smoke of combustion, and in the case of a candle the lamp becomes hot and the candle melts.

(*c*) The most satisfactory aiming mark is an electric box as described in Appendix X.

The light can be switched on from the gun position and can be put out as soon as the firing is completed. The box is easily carried and is not likely to break during transport.

The aiming mark is 12 inches wide, and therefore, when placed 9½ yards from the gun, gives a traverse of 2 degrees. This is a great advantage over "point" aiming marks, where the limit of traverse has to be guessed.

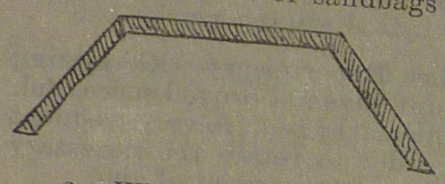
With this aiming box, used in conjunction with the luminous bar foresight (Appendix X.) and a luminous backsight, any type of indirect fire, including barrage fire, can be performed by night with accuracy.

3. *An Electric Torch* is essential at the gun for reading graduations on the Direction Dial and tangent sight, and for setting the clinometer.

4. *Depression Stops* and *Traversing Stops*, when set correctly, automatically ensure the safety of our own Infantry, and thus diminish the strain on the firer.

5. *Flash Obscurers* have been produced which effectively conceal the flash from view, but they invariably disperse the cone to such an extent that they make overhead fire impossible. Consequently, there is no pattern which can be recommended.

On the other hand, it has been proved experimentally that screens of canvas or sandbags have no effect on a cone which is fired through them, and such screens when wet effectively screen the flash. Care should be taken to screen the flash at the sides as well as the front.



6. When the firing is done from positions some way behind our front line, and especially when this is reached by overland routes, special precautions must be taken against endangering friendly troops who are passing near the gun position.

This is done by posting sentries or by wiring in the danger area. The safety of working parties and patrols in No Man's Land must be secured by liaison with Battalions.

14.—SEARCHING REVERSE SLOPES.

In order to search a reverse slope effectively, the gun must be placed at such a distance from the crest that the fall of the bullet is steeper than the slope of the ground.

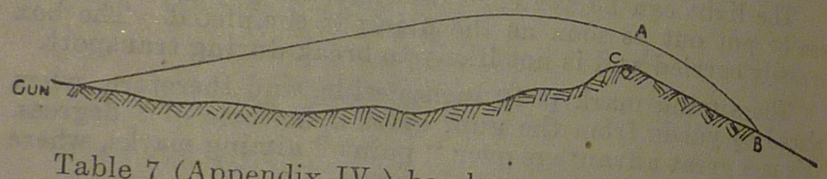


Table 7 (Appendix IV.) has been compiled to enable the machine gunner to do this without making elaborate calculations. If this Table be used according to the following instructions, the angle ABC (*see* diagram above) will be between 100 and 200 minutes.

1. METHOD OF USING TABLE 7.

(i.) Find the fall in yards, per 100 yards of the slope. To do this it is best to find the fall for several hundred yards of the slope, and then calculate the average fall per hundred yards.

(Suppose the fall is 6 yards per 100 yards.)

(ii.) Draw a line on the map representing the probable line of fire. This will be so as to engage the target in enfilade when possible.

(iii.) Observe from the map, whether the gun is likely to be above or below the top of the slope.

(iv.) Suppose it is above. On the right half of Table 7 (Gun above Crest) and in the top column find the figure 6, and notice the range in the column beneath it (*i.e.*, 1,400 yards).

(v.) Measure back from the top of the slope 1,400 yards along the line of fire.

(vi.) Find the difference between the height of this point and the height of the top of the slope (say 20 yards).

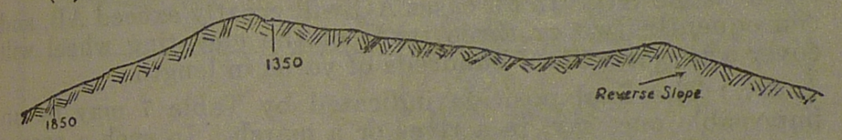
(vii.) Find 20 in the centre column, and, reading along the column to the right, find the range below the 6 in the top column (*i.e.*, 1,600 yards).

(viii.) Measure back 1,600 yards from the top of the slope, along the line of fire. The point thus found is the point in which to place the gun.

(ix.) Knowing the gun position, and the position and height of the top of the slope, find by the ordinary methods of indirect fire, the direction and elevation necessary to hit the top of the slope.

2. SPECIAL POINTS.

(i.) In certain cases both sides of Table 7 may be satisfied.



Example:—

Fall 5 yards per 100 yards.

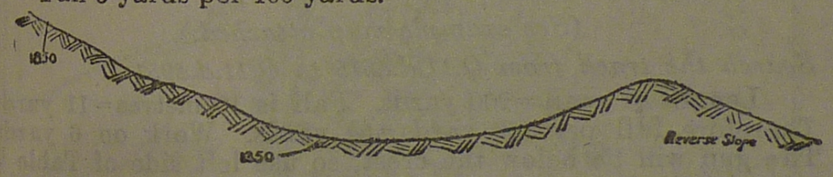
Then using the right side of Table 7, the gun must be placed 1,350 yards from the slope, when the gun is above the crest. Or, using left side, if the range is 1,850 yards, the gun must be below the crest.

In such a case the controller can decide for himself which position is the best to occupy.

(ii.) Neither side of Table 7 may be satisfied.

Example:—

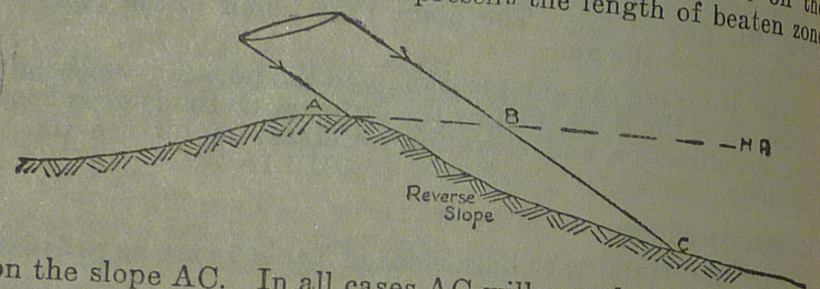
Fall 5 yards per 100 yards.



On measuring back 1,350 yards, the gun may be *below* the crest, and in measuring back 1,850 yards, the gun may be *above* the crest. In such a case, which will be extremely rare, choose a position between the two which is on the same level as the crest. The reverse slope can be engaged from this position.

(iii.) As the searching of reverse slopes is just a special type of indirect fire, searching and traversing will be employed as usual, with the exception that searching will be very restrained.

If AB represents the length of the beaten zone on the horizontal plane, AC will represent the length of beaten zone



on the slope AC. In all cases AC will greatly exceed AB, and consequently two or three turns of the elevating wheel will cover a target several hundreds of yards in length.

(iv.) The final position indicated by Table 7 may be an impossible one, say, in a river or a marsh. In such a case a gun position should be selected further away from the slope rather than nearer to the slope.

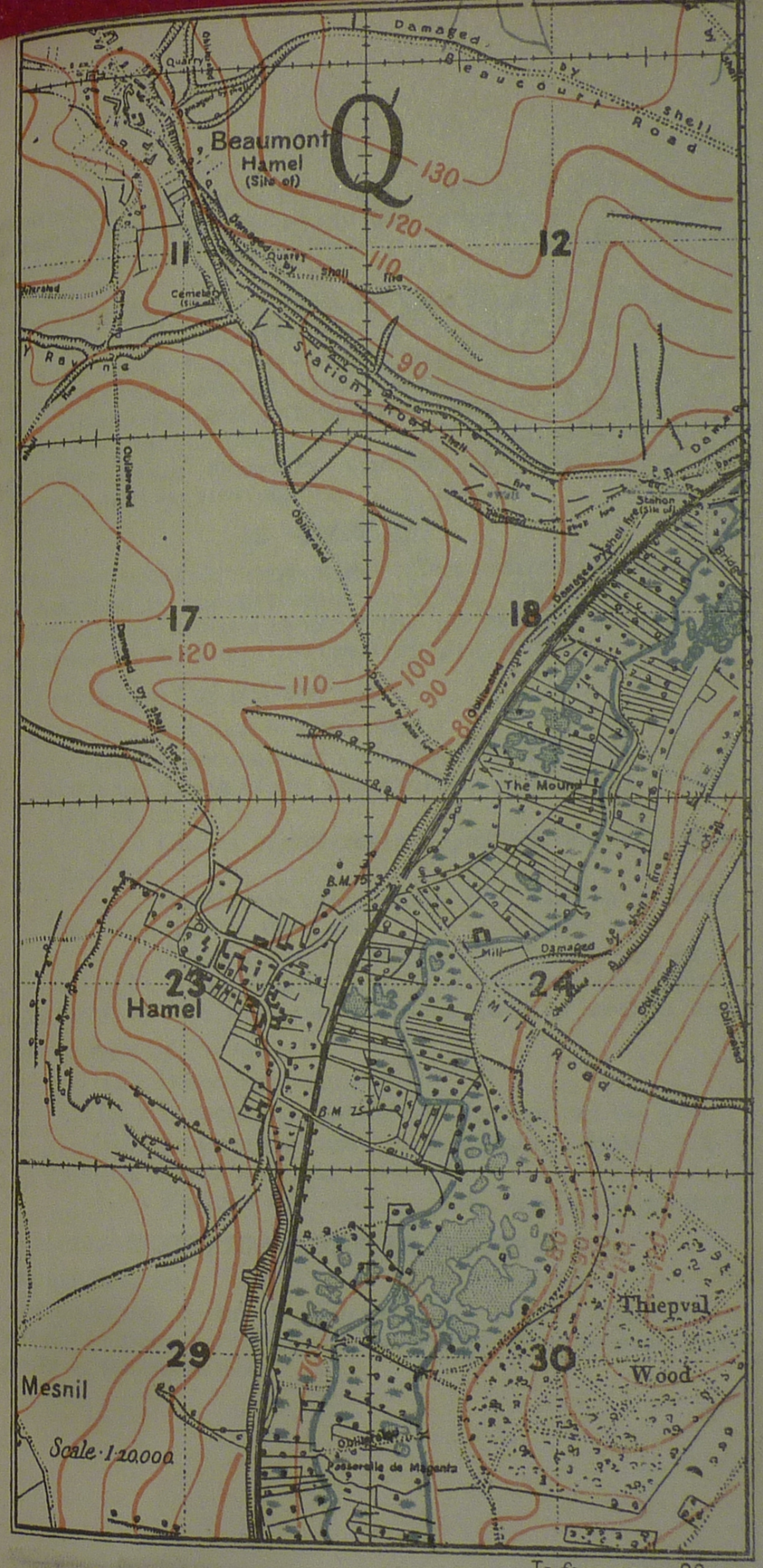
By moving further back the range is increased, and consequently the angle of descent of the bullet, but by going nearer to the crest the angle of descent is decreased, and it may become impossible to search the reverse slope at all.

(v.) Fire should be directed at the top of the target, which may, or may not, be the crest of the hill. If the top of the target is not the top of the hill, calculations should be made to see if the hill will be cleared or not. If the crest is not cleared, the gun should be taken back to such a range that the obstruction will be cleared.

(*See example map attached.*)

Search the track from Q.11.d.4615 to Q.11.d.3951.

Length of road = 200 yards. Fall is 10 metres = 11 yards. Therefore fall per 100 yards = $5\frac{1}{2}$ yards. Work on 6 yards. The gun will be below the crest, so use left side of Table 7.



To face page 88

Measure back 1,850 yards (*i.e.*, Q.24.c.22.51). Height of this position is 71 metres. Height of top of target is 110 metres. Therefore the gun is 39 metres = 43 yards below the top of the target.

Find 40 in the centre column of Table 7, and find the range opposite this and below the 6 on the left (*i.e.*, 1,800 yards). This is the final gun position (at Q.24.c.20.57). If this point is unsuitable for a gun position, move back along line of fire until a suitable position is found (say, at Q.24.c.3100) Then calculate the angle of quadrant elevation in the usual manner, and before firing ascertain whether the obstruction at Q.17.b.60.30 will be cleared.

15.—ERRORS.

The most probable errors which affect indirect laying have been described in the preceding analysis. These errors are now summarised in order to assist the Machine Gun Company Commander to draw up his training programme.

Errors on the part of Officers.

(i.) Inaccurate map work.

(ii.) Inaccurate compass work, which may affect both the fixing of the gun position and laying out the line of fire.

(iii.) Choice of reference object too near the gun position.

(iv.) Inaccurate calculations and failure to allow for atmospheric changes.

(v.) Use of instruments such as clinometers, angle of sight instruments, when not in accurate adjustment, and of worn-out material, such as barrels, etc.

Errors on part of Personnel.

(i.) Inaccurate aiming.

(ii.) Inaccurate placing of elevation on the gun.

(iii.) Inaccurate use of traversing dials, "T" aiming marks and bar foresights.

(iv.) Failure to "oil up," etc., during a barrage.

16.—MODIFICATIONS IN EQUIPMENT.

1. SAFETY DEVICES.

In order to secure the safety of the troops, over whose heads fire is being directed, it is most important to ensure the rigidity of the mounting.

Without this, traversing and depression stops do not prevent fire becoming dangerous if the mounting sinks, because these form parts of the mountings. This rigidity is obtained:—

(i.) By careful construction of firing platforms.
(ii.) By the use of "T" bases.

The latter is much preferable.

Fig. 1, Appendix IX., shows a type of "T" base easily made, but which must be adjusted to each tripod.

Fig. 2, Appendix IX., shows a type which is:—

(i.) Collapsible and therefore more easily carried, and less likely to render the carrier conspicuous.
(ii.) Adjustable.

After the tripod has been placed on the "T" base, which in soft ground should be reinforced by a layer of sandbags underneath, a few sandbags are placed across the legs.

Provided that a rigid mounting has been obtained, traversing stops prevent the firer swinging his gun beyond the prescribed limits of traverse.

At the same time depression stops prevent the fire becoming dangerous by depression of the gun.

2. In order to obtain the accuracy of direction now required for indirect fire, it is necessary to be able to lay off to 10 min. This cannot be done by the direction dial, and is done by:—

(i.) The "T"-shaped aiming mark, Fig. I., Appendix X.: This is graduated in inches, and, when placed 9½ yards from the gun—

1 inch represents a traverse of 10 minutes.
6 inches ,, ,, ,, ,, 1 degree.

The aiming mark gives a traverse of 3 degrees either side. It cannot be used at night.

(ii.) The combination of the bar foresight, telescopic aiming post and night-firing box, Fig. 2, Appendix X., allows:—

(*a*) 7 deg. either side of the centre to be laid off and readings to 10 min. intervals.

(*b*) A traverse of 2 deg. either side of the centre line by placing the post 9½ yards from the gun, with arms horizontal.

(*c*) Elevation through 4 deg. if the arms are vertical.

(*c*) Elevation through 4 deg. if the arms are 1 deg. either side of centre without moving the cursor on the bar foresight, and 7 deg. to be laid off either side of the centre by moving the cursor.

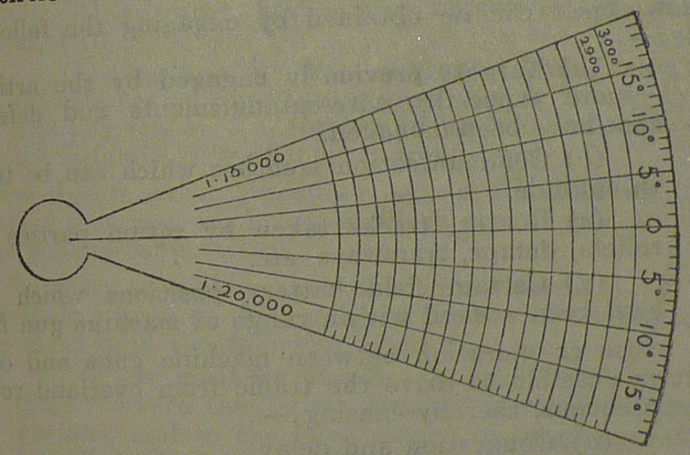
3. Bayonet signalling shutters (Venetian flappers) have been often used for controlling the fire of a battery.

4. Condenser bags have been found useless, and are replaced by petrol tins.

5. The introduction of a rotatable dial much simplifies laying off angles, as it overcomes the difficulties of addition and subtraction, over which mistakes have been easily made in the past.

6. The necessity of accurate indirect fire by a large number of guns renders necessary clinometers on a scale of one per gun.

7. Some form of large protractor in the shape of a sector of a circle with an angle of 30-45 deg.



17.—MACHINE GUN BARRAGE FIRE.

(*See Part I., Sec. 5 and 6.*)

1. Barrage fire by machine guns is the fire of a large number of guns acting under a centralised control, directed on to definite lines or areas, in which the frontage engaged by a gun approximates 40 yards.

Barrage fire is carried out by:—

(i.) Artillery.
(ii.) Trench Mortars.
(iii.) Machine Guns.

The best results in any operation can only be obtained by conceiving the barrage plan as a whole and allotting to the different weapons tasks which their characteristics render them most fitted to carry out.

There are four types of barrage fire:—

(i.) Preliminary bombardment.
(ii.) Creeping barrage.
(iii.) Standing barrage.
(iv.) Back area barrage.

2. The "harassing fire" of machine guns forms an integral part of the preliminary bombardment, and the object of the fire is to:—

(i.) Lower efficiency of enemy working parties.
(ii.) Increase difficulty of transport of munitions and supplies.
(iii.) Cause deterioration of enemy morale.

This object can be obtained by engaging the following targets:—

(*a*) Targets previously engaged by the artillery —more especially wire-entanglements and defences that have been damaged.

(*b*) Communication trenches which can be taken in enfilade.

(*c*) Routes, tracks taken by ration parties and reliefs, dumps, tramways, etc.

(*d*) Certain field battery positions which may have been erected within range of machine gun fire.

By close co-operation between machine guns and other arms it is possible to drive the traffic from overland routes into the trenches, thereby causing:—

(*a*) Congestion and delay

(*b*) Casualties from the artillery fire on the communication trenches from their enfilade guns.

During the period more closely approaching zero day when the enemy defences have been knocked about and the morale of the garrison has been shaken, the plan of concentrating the guns of one battery on to carefully chosen centres

of activity, and opening rapid fire for a short period is effective. This type of fire is known as "area shooting." This treatment should be applied to different points at irregular intervals.

3. The objects of barrage fire on zero day are to:—

(*a*) Prevent the enemy manning his parapets and installing his machine guns.

(*b*) Interfere with the effective use of machine guns in rear.

(*c*) Prevent supplies of food and ammunition being brought up.

(*d*) Prevent reinforcement of the garrison.

(*e*) Destroy morale.

(*f*) Place a protective barrage at every definite stage of an advance.

(*g*) Save our own troops at all times from casualties by keeping down the fire of the enemy infantry, machine guns, etc.

By these means Infantry Battalions are enabled to:—

(*a*) Advance and seize objectives previously allotted.

(*b*) Organize for defence ground won during the delicate period when troops are suffering from nervous and physical strain, the loss of leaders and men, and the unfamiliarity of their surroundings.

These objects are obtained by creeping, standing and back area barrages carried out by the artillery, trench mortars, and machine guns in conjunction.

4. In order to enable the machine guns to carry out the *rôle* allotted to them in the barrage scheme, the machine gun barrage must fulfil the following conditions:—

(i.) It must be equally applicable to the "set piece" where the "time factor" is relatively unimportant, and to the later stages of large operations involving the forward movement of batteries to new positions from which to create a barrage, in which case the "time factor" becomes of paramount importance.

(ii.) It must apply also to conditions of semi-open and open warfare, becoming relatively more important as the troops get out of range of the bulk of their artillery.

(iii.) It must be flexible, *i.e.*, it must be possible to create a zone of intense machine gun fire on any area with accuracy and rapidity.

(iv.) It must be capable of being taught and carried out as a drill.

These conditions can only be obtained by simplicity of:—

(*a*) Organization.
(*b*) Laying.
(*c*) Fire Control.
(*d*) Drill.

5. ORGANIZATION OF GUNS FOR BARRAGE FIRE.

(*a*) Guns for barrage fire are organized into groups and batteries. The group normally consists of between 16 and 32 guns. If the group is considerably larger, it will be necessary to divide it into sub-groups, each under a sub-group commander. The group is commanded by the Group Commander, who is a Company Commander, but may be the D.M.G.O.

His normal position is at the Brigade Headquarters in whose area he is operating. He is assisted by an officer. Normally each Brigade has one group of barrage guns.

The group is divided into batteries or fire units of 4, 6 or 8 guns. The normal size of a battery is 8 guns. Each battery is commanded by an officer who is known as the Battery Commander. He is assisted by one officer per four guns and one N.C.O. to every two guns—who is not below the rank of corporal. Each gun is commanded by a N.C.O. or senior private—who is *not* the No. 1 of the gun and is known as the Gun Commander.

Batteries are lettered from the right A, B, C, etc., throughout the Corps front; in the case of a forward move these become A2, B2, C2, etc., for the first move; A3, B3, C3, etc., for the second move, and so on.

(*b*) The duties of the Group Commander are:—

(i.) To carry out the orders of the D.M.G.O.

(ii.) Organize his group into batteries.

(iii.) To make all preliminary preparations, which include estimates of S.A.A., oil, water, etc.

(iv.) To make preparation for the formation of dumps and communications.

(v.) Issue operation orders which deal with the location and tasks of each battery. The task is in the form of a table showing the times, targets, rates of fire for each lift, and any moves. These orders must be issued in ample time for the Battery Commander to make his calculations and send these to the Group Commander to check.

(vi.) To provide himself with a fighting map showing zero lines and tasks of each battery (Appendix VII., No. 1).

(*c*) The duties of the Battery Commander are:—

(i.) To lay out the zero lines of his battery in the position ordered by the Group Commander.

(ii.) To carry out orders of the Group Commander detailed above in (iii.), (iv.), and (v.).

(Specimen of Battery Charts, Appendix VI.)

(iii.) To issue a gun chart to each Gun Commander. (Appendix VI., No. 3.)

(iv.) To provide himself with a fighting map showing zero lines and tasks of his battery. (Appendix VII., No. 2.)

(v.) To see that every "Commander" in his battery, including himself, is provided with an understudy.

(vi.) To supervise the fire of his battery.

(*d*) The duties of the Gun Commander are:—

(i.) To control the fire of his gun as ordered on his gun chart.

(ii.) To control the fire as taught in "Barrage Drill."

(iii.) To see the correct elevation and direction is *placed* and *maintained* on his gun.

(iv.) To watch for signals from the officer controlling the fire.

(v.) In the event of a barrage not on the chart being ordered, to see that the correct fire order is passed down, and that his gun is correctly laid before repeating "No. — gun, ready to fire."

These duties can only be performed *in toto* when the tactical situation permits. It will often be impossible to prepare elaborate fighting maps and charts.

6. LAYING AND FIRE CONTROL.

Although machine gun barrage fire can be carried out by controlling the fire of each gun singly, experience has shown that the barrage so produced is not flexible, that calculations are laborious, and control difficult.

The introduction of the Battery System (*see* Section 10) has rendered it possible to produce a flexible barrage, easily controlled and obtained by the aid of extremely simple calculations. This is the normal method of producing machine gun barrage fire.

7. BARRAGE DRILL.

In order that a battery may work in the field with efficiency, the methods of battery fire must be learnt as a drill. This will enable the personnel in action to reproduce automatically the movements learned in practice, with such modifications as the conditions of battle may impose.

Equipment Required.

Guns and tripods.
Spare parts.
Ammunition boxes (4 per gun).
Condenser tubes and bags (or petrol tins).
"T" shaped bases.
Zero aiming posts and "T" aiming marks.
Sandbags and shovels.
Shutter for controlling fire.
Clinometers or spirit levels.
Megaphone.

First Stage.

Guns and equipment will be laid out as in elementary drill. A Gun Commander will be appointed for each gun.

(i.) "FALL IN."—Teams fall in as in elementary drill, Gun Commanders on the right of No. 1. Teams in line, dressed by the right.

(ii.) Battery Commander indicates the reference object (if one is being employed).

(iii.) "NUMBER."—As in elementary drill.

(iv.) "TAKE POST."—As in elementary drill, all numbers standing to attention.

No. 3 has with him condenser bag (or petrol tin), four boxes of ammunition and aiming post.

No. 4 has "T" shaped base and shovel. Gun Commander takes up position on left of No. 1, with cleaning rod and clinometer.

(v.) "TELL OFF BY GUNS."—Gun Commanders number off from the right:—No. 1 gun, etc.

(vi.) "PREPARE FOR BARRAGE."—No. 1 examines the tripod and No. 2 prepares the gun (condenser tube fixed) for action.

No. 3 inspects the ammunition.

No. 4 doubles forward with "T" shaped base and shovel.

Battery Commander aligns "T" shaped bases, and on the Battery Commander's signal Nos. 4 fix the bases firmly in the ground, and double to the rear.

Nos. 5 and 6 fill sandbags and prepare for belt filling, under cover.

Second Stage.

To obtain parallel zero lines in the required direction, the following is only one of several methods taught. All methods should be practised.

(vii.) "FLANK GUNS—MOUNT GUN."—The flank guns mount on the "T" shaped bases, Nos. 4, 5 and 6 bringing up sandbags, guns lay on each other, No. 2 of each gun notes reading on direction dial and signals with his hand to the other No. 2, when this is complete. Both guns now lay on R.O. and note the angle swung through. These angles are passed along to the Battery Commander, who then calculates the distribution angle to obtain parallel lines.

(viii.) "REMAINDER — MOUNT GUN."—Remaining guns mount guns on "T"-shaped bases and lay on R.O.

No. 3 of each gun brings up four boxes of ammunition and condenser bag (or petrol tin).

Nos. 4, 5 and 6 bring up sandbags.

Nos. 2 and 3 sandbag the tripod.

No. 2 fixes condenser bag (or petrol tin).

Gun Commander takes up clinometer and cleaning rod.

(ix.) "ALL GUNS—DEGREES RIGHT OR LEFT."—(This angle will be such that it brings the zero lines of the directing gun in the required direction.)

This order is repeated by Nos. 1 in succession from the left, who immediately lay off the angle ordered.

Nos. 3 double forward to the gun, and pace out 9½ yards carrying zero posts and "T" shaped aiming marks. The "T" aiming mark is placed as ordered by No. 1, and is held in position by No. 3, pending the order of distribution to obtain parallel lines.

(x.) "No. —— GUN DIRECTS."—(Normally this will be left gun.) This order is repeated by each No. 1.

(xi.) "DISTRIBUTE 20 min."—This is the angle obtained by the battery commander in para. 7.

The angle 20 min. has been used simply for the purpose of illustration. The same applies to all subsequent angles.

Then for a battery of eight guns this order would be passed along as follows:—

No. 1 of No. 8 gun repeats "Distribute 20 min." No. 3 fixes zero post and "T" aiming mark as ordered by No. 1.

No. 1 of No. 7 gun repeats "20 min. right—Distribute 20 min.," and lays off 20 min. right on "T" aiming mark. No. 3 then fixes zero post and "T" aiming mark as ordered by No. 1.

No. 1 of No. 6 gun repeats "40 min. right—Distribute 20 min.," and lays off 40 min. right on "T" aiming mark. No. 3 then fixes zero post and "T" aiming mark as ordered by No. 1—and so on for the remaining guns.

The guns are now laid on their parallel zero lines.

Before proceeding with the drill the Battery Commander will order "Check zero lines," when the orders given in 9, 10 and 11 will be repeated, with the exception that the zero posts will be left in the ground.

These zero posts will not be moved once parallel lines have been obtained.

(xii.) "STAND CLEAR."—Teams fall in five yards in rear of gun and stand at ease.

Third Stage.—Distribution and Concentration.

(xiii.) "STAND TO."—Nos. 1 and 2 take up their positions at the gun. The Gun Commander kneels down with the clinometer on the left of No. 1.

(xiv.) EXAMPLES OF DISTRIBUTION.—"All guns 6 deg. right." Each No. 1 repeats and lays off 6 deg. right from zero, using direction dial.

"No. 8 Gun Directs." Each No. 1 repeats.

"Distribute 1 deg. 10 min." This order is carried out as explained in 11.

(xv.) EXAMPLE OF CONCENTRATION.—"All guns 5 deg. left." Each No. 1 repeats and lays off 5 deg. left from zero, using direction dial.

"No. 8 gun directs." Each No. 1 repeats.

"Concentrate 20 min." No. 1 of No. 8 gun repeats "Concentrate 20 min."

No. 3 fixes his "T" aiming mark.

No. 1 of No. 7 gun repeats "20 min. left—Concentrate 20 min.," and lays off 20 min. left on the "T" aiming mark. No. 3 then fixes the "T" aiming mark as ordered by No. 1.

No. 1 of No. 6 gun repeats "40 min. left—Concentrate 20 min.," and lays off 40 min. left on "T" aiming mark. No. 3 then fixes the "T" aiming mark as ordered by No. 1—and so on.

(xvi.) "LOAD."—As in elementary drill.

(xvii.) "ELEVATION 3 deg."—Each No. 1 repeats and Gun Commander lays the gun for elevation.

No. 1 adjusts the tangent sight on the "T" shaped aiming mark, and notes the reading.

(xviii.) EXAMPLE OF COMBINED SIGHTS.—"Elevation 4 deg. 20 min.—20 min. differences." No. 1 of No. 8 gun repeats "Elevation 4 deg. 20 min.—20 min. differences."

Gun Commander sets clinometer at 4 deg. 20 min.

No. 1 of No. 7 gun repeats "Elevation 4 deg. 40 min.—20 min. differences."

Gun Commander sets clinometer at 4 deg. 40 min.

(xix.) TRAVERSE will be 1 deg. right, 1 deg. left, unless otherwise ordered. No traverse for concentration.

(xx.) RATE OF FIRE—Slow, medium, or rapid.

(xxi.) "FIRE."—Shutter lowered.

Bursts of fire should not be less than 15-20 rounds.

No. 1 relays between bursts.

Unless concentrating tap between bursts.

Accuracy in relaying must always be insisted on.

(xxii.) "CEASE FIRE."—Shutter released.

Procedure after first lift or first belt. (Whichever is shorter.)

No. 1 unloads and clears gun.

No. 2 removes outer casing, tests muzzle cup and clears the barrel, replaces outer casing.

No. 1 oils up, reloads and lays for direction.

Gun Commander puts on elevation.

No. 2 signals ready to fire.

Procedure after every 1,000 rounds:—

No. 1 unloads and clears gun.

No. 2 cleans barrel and replenishes water in barrel casing. (If necessary.)

No. 1 oils up, reloads and lays for direction.

Gun Commander puts on elevation.

No. 2 signals "Ready to Fire."

(xxiii.) "UNLOAD."—As in elementary drill. Gun Commander reports "No. 1 gun clear," "No. 2 gun clear," and so on.

(xxiv.) "OUT OF ACTION."—Guns dismounted at firing point.

Nos. 3, 4, 5 and 6 double forward and retire with aiming posts, belt boxes, "T" shaped bases, etc.

NOTE.—Interchange gun numbers as frequently as possible.

Fourth Stage.

(xxv.) Batteries should be practised in coming into action in different positions, obtaining parallel lines by different methods, and firing by barrage charts. In the latter case verbal orders should be dispensed with as far as possible.

(xxvi.) In the final stages of training, batteries should be practised on the ground from the map of the district, and

Group Commanders should practise the Battery Commanders in applying the fire of their batteries to any target with rapidity and accuracy.

NOTE.—In elementary stages it may be found better for the Gun Commanders to pass orders rather than the Nos. 1.

8. RATES OF FIRE.

(i.) To prevent waste of S.A.A., to ensure time for relaying and oiling (thereby prolonging the life of the gun), and to enable estimates of S.A.A. to be made in advance, rates of fire must be laid down for rigid observance by each gun.

(ii.) Normal rates of fire are:—

(*a*) *Slow fire.*—60—75 rounds per minute fired in bursts of 15—25.

This is the rate for long period barrage fire.

(*b*) *Medium fire.*—125—150 rounds per minute. This is the rate that can be used to speed up slow fire for short periods. It can be maintained for about half-an-hour, and should not be attempted for a longer period.

(*c*) *Rapid fire.*—250—300 rounds per minute. This rate is used in response to S.O.S. calls, but should only be maintained for a few minutes, after which the fire should be reduced to medium or slow rate.

(*d*) *Harassing fire.*—1,000 rounds per hour. This may be carried out at slow, medium, or rapid rates.

(iii.) Before ordering rates of fire, the following factors must be considered:—

(*a*) Tactical requirements of the barrage.

(*b*) Frontage per gun.

Obviously it will be necessary, if the concentration of guns is thin, to fire at a more rapid rate than if the concentration is thick, in order to produce the same result.

(*c*) Time during which the barrage is to be fired.

(*d*) Number of filled belts per gun available.

(*e*) Rate at which belts can be filled.

(*f*) Wear and tear of guns.

Assuming two belt-fillers per gun, and the rate of belt filling by hand to be:—

4 belts per man the 1st hour.
3 ,, ,, ,, ,, 2nd hour.

If 14 belts per gun are available, then

(i.) It will be possible to fire 22 belts in one hour —*i.e.*, 5,500 rounds, but this will leave all the belts empty.

(ii.) It will be possible to fire 28 belts in two hours, *i.e.*, 3,500 rounds per hour.

It is the belt problem which imposes the "Slow Rate of Fire" for all long period barrages, and it is advisable to increase the number of belts per gun for large operations.

9. LIFE OF BARRELS.

The most important factors which affect the life of barrel are:—

(i.) The temperature of the water.
(ii.) Oiling.

(*a*) With the rate of fire approximating 1,000 rounds per hour, fired intermittently, frequent oiling of the barrel, the water below boiling point or only boiling for short periods, the life of the barrel is 20,000 to 25,000 rounds.

This corresponds to "Harassing Fire."

(*b*) With a rate of fire exceeding 3,500 rounds per hour, fired continuously, frequent oiling of the barrel, the water boiling for long periods, the life of the barrel is 12,000 to 15,000 rounds.

This corresponds to normal forms of barrage fire and S.O.S. calls.

(*c*) A failure to oil the barrel in both the above cases at regular intervals appears to decrease the life by 3,000 to 4,000 rounds.

The loss of range due to worn barrels is not at present definitely known, but experiments have shown that the lengths of the beaten zones become nearly twice those given in the tables, and that the loss apparently does not exceed 5 per cent. of the range.

18.—COMMUNICATIONS.

(See Part I., Section 29.)

1. No proper fire control is possible without a comprehensive system of telephonic communications. This necessitates the most careful co-ordination of the machine gun signalling personnel available.

SYSTEM OF COMMUNICATIONS.

2. *Offensive Operations.*

(*a*) Forward Guns.—These can communicate through the Battalion report centre, in whose area they are operating. (*See* Sec. 4, para. 12, and Sec. 29, para. 2, of Part I.)

(*b*) Rear Guns.—Appendix III., A, shows the system where one group of guns is affiliated to one Brigade; when batteries move forward they connect to the Brigade Forward Station. When the Brigade Commander moves forward to the forward station the Group Commander accompanies him, and so keeps in touch with his batteries and Forward Observation Station.

3. *Trench Warfare.*

Appendix III., B., shows system for a Division with two Brigades in the line.

Owing to the necessity for Brigade and Battalion Commanders to be able to communicate quickly with Machine Gun Company Headquarters, and the necessity of keeping messages secret, Fullerphones are required at each Machine Gun Company Headquarters. In cases where sniping batteries are employed, these must be connected by telephone to a forward observation station, from which the controlling officer sends down the necessary fire orders to engage any target he wishes.

4. *Open Warfare.*

Companies should maintain their communications with Sections by signal or wire.

Brigades will be responsible for maintaining communications with Companies.

NOTE.—Further information on this subject is given in S.S. 191, *Intercommunication in the Field.*

APPENDIX I.

ORDERS FOR GUN POSITION No.....

1. Fire is only to be opened by order of the Gun Commander unless a sudden emergency arises, in which case the sentry will use his own initiative.

2. When relieving another gun team or sentry, the following facts will always be ascertained:—
   (*a*) Whether the gun has been fired during the relief.
   (*b*) If fired, what the target was.
   (*c*) If fired, the emplacement from which it was fired.
   (*d*) Whether any instructions have been received as to friendly patrols or wiring parties.

3. The sentry will always inspect the gun when taking over the position.

4. The sentry on duty must have an accurate knowledge of the targets shown on the fighting map.

5. In case of alarm, or a gas attack, the sentry will wake the gun team.

6. The gun will be cleaned daily, and the *points before firing* gone through both morning and night. The gun must be kept free from dirt, and in the trenches may be kept wrapped up in a waterproof sheet or bag. Such a covering must not prevent the gun being mounted for action immediately.

7. Ammunition, spare parts, and anti-gas apparatus will be inspected daily.
   The Gun Commander will be responsible that all anti-gas apparatus is always in position and in order.

8. The lock spring will never be left compressed.
   With the Vickers gun it is generally sufficient to half-load and then press the thumb-piece when mounting the gun at night. In order to open fire, it is only necessary to complete the loading motion and press the thumb-piece.

9. All dug-outs, emplacements and ammunition recesses belonging to the gun position must be kept clean and in good repair.

SPECIAL ORDERS FOR THIS GUN POSITION.

1. The S.O.S. signal is _____
2. Action on S.O.S. _____
3. Action if enemy penetrates our front line _____
4.
5.
6.

LIST OF STORES BELONGING TO THIS GUN POSITION

Article	Number	Remarks
Fighting Map ...		
Barrage Chart ...		
Intelligence Summary		
Mountings (pivot, box, wooden base, etc.) ...		
Mills Grenades ...		
Picks ...		
Shovels ...		
Refuse tin ...		
Sundries ...		

Date_ _ _____ *Machine Gun Officer.*

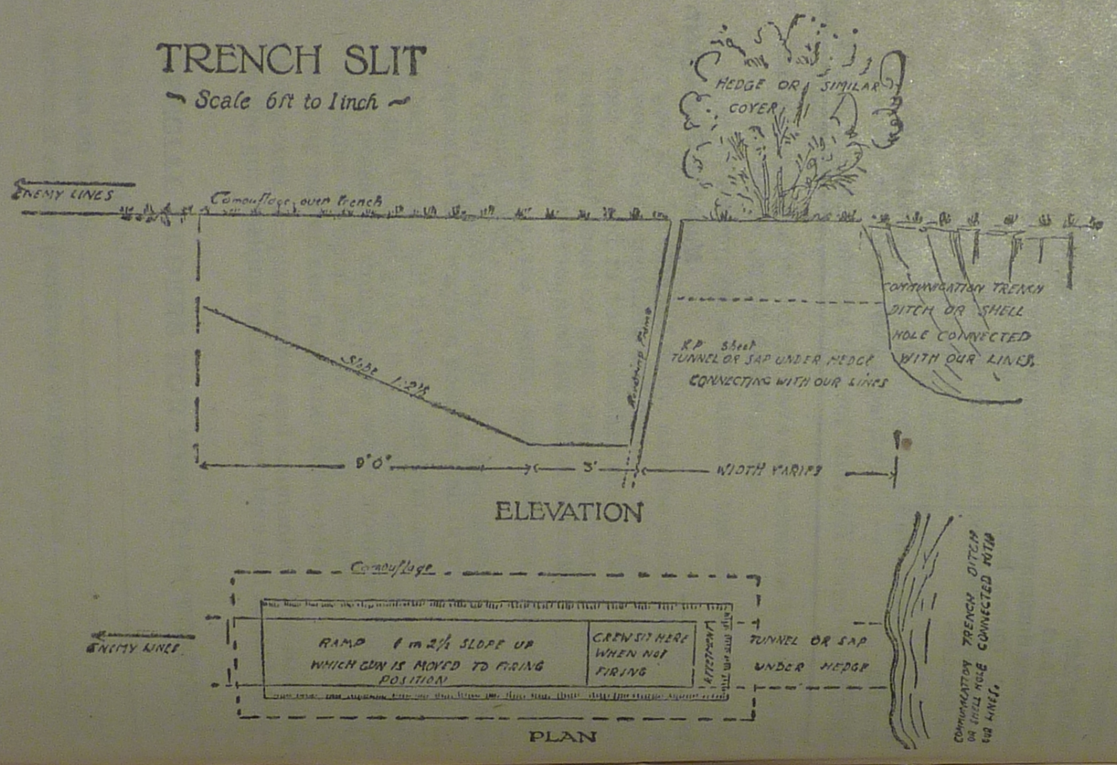
APPENDIX II.

TYPES OF MACHINE GUN EMPLACEMENTS.

(a)

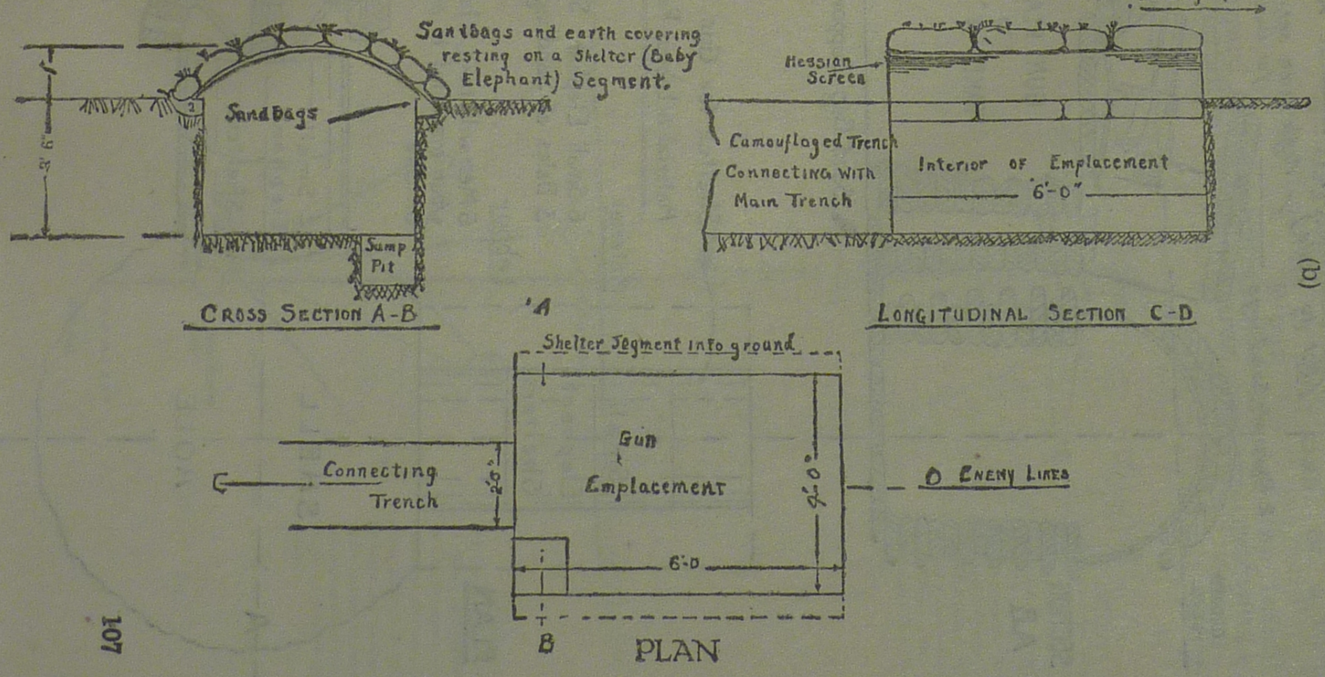
TRENCH SLIT

~ Scale 6ft to 1inch ~



EMPLACEMENT. With overhead Cover.

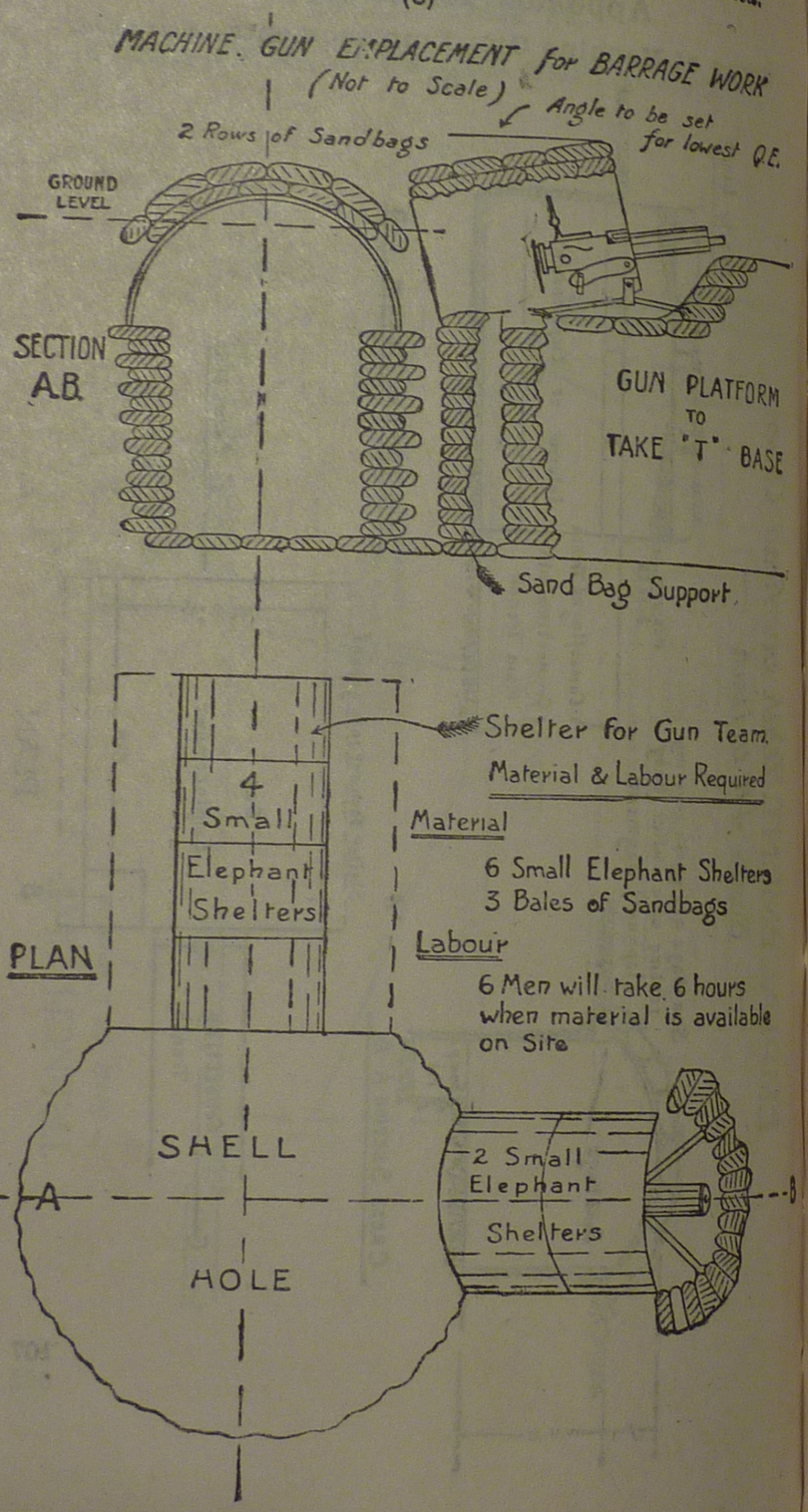
~ Scale 4ft to 1inch ~



range-takers and instruments."

Types of Machine Gun Emplacements—*continued.*

(c)



Material & Labour Required

Material

6 Small Elephant Shelters
3 Bales of Sandbags

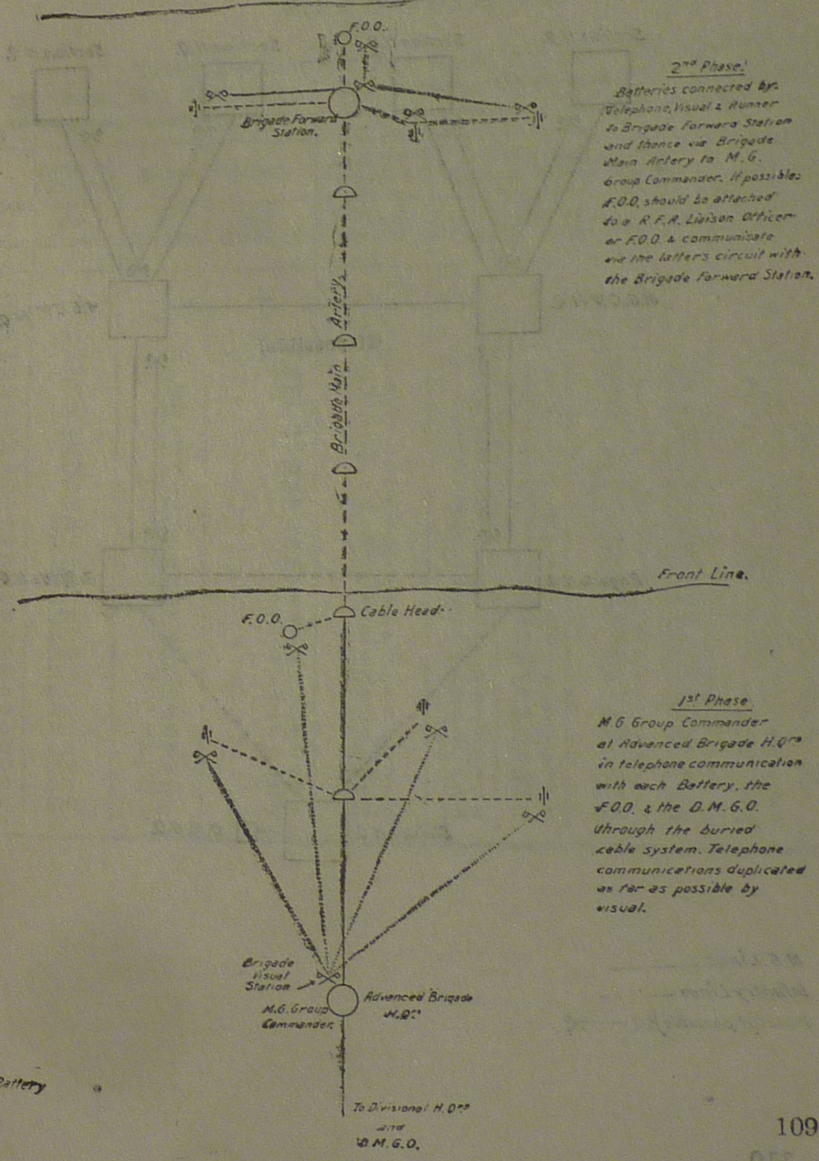
Labour

6 Men will take 6 hours when material is available on Site

APPENDIX III.

A.—OFFENSIVE OPERATIONS.

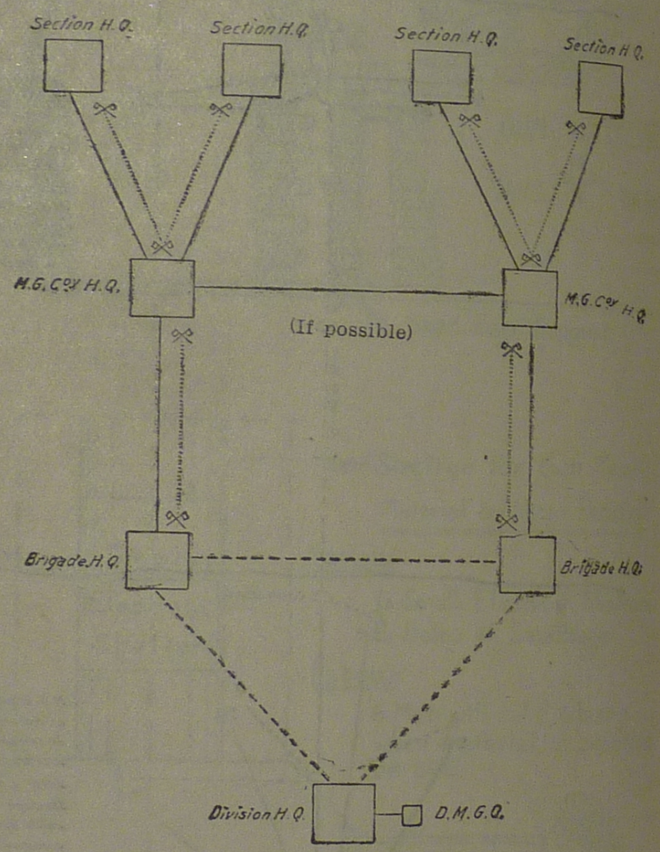
Typical Communications of Rear Guns on a Brigade Front.
Forward Guns communicate through the Infantry Battalions in whose area they are operating.)



Appendix III.—*continued.*

B.—TRENCH WARFARE.

Typical Communications of Machine Guns on a Division Front.
(Forward sections communicate through the Infantry Battalions in whose area they are operating.)



M G Lines _____
Infantry Lines - - - - -
Visual (if possible) ⚔ ..... ⚔

APPENDIX IV.

TABLE I.—TANGENT ELEVATION, ANGLES OF DESCENT, DIMENSIONS OF CONES AND ZONES, &c. ·303 VICKERS GUN, MARK VII AMMUNITION.

1	2	3		4	5				6	
Range.	Angle of Tangent Elevation.	Slope of Descent.		Height in yards of lowest shot below cr. of cone.	Dimensions in yards of horizontal beaten zones.				Dimensions of cones in yards.	
					Width.		Length.		Width.	Height.
Yards.	Minutes.	In Minutes.	As a Gradient.		75 p.c.	90 p.c.	75 p.c.	90 p.c.	75 p.c.	75 p.c.
100	3	—	—	—	—	—	—	—	—	—
200	7	—	—	.7	.3	—	—	—	.3	—
300	11	—	—	1.0	.5	—	—	—	.5	—
400	16	15	One in 230	1.3	.7	—	—	—	.7	—
500	22	23	,, 149	1.7	.8	2.3	220	700	.8	1.5
600	28	32	,, 107	2.0	1.0	2.8	204	600	1.0	1.9
700	35	42	,, 82	2.3	1.2	3.3	188	525	1.2	2.3
800	43	54	,, 64	2.7	1.3	3.8	172	450	1.3	2.7
900	52	69	,, 50	3.0	1.5	4.3	156	375	1.5	3.1
1000	62	88	,, 39	3.3	1.7	5.0	140	300	1.7	3.6
1100	73	111	,, 31	4.0	2.0	6.0	126	270	2.0	4.1
1200	86	139	,, 25	4.7	2.3	7.0	112	240	2.3	4.5
1300	101	172	,, 20	5.3	2.7	8.0	98	210	2.7	4.9
1400	117	209	,, 16	6.0	3.0	9.0	84	180	3.0	5.2
1500	135	251	,, 14	6.7	3.3	10.0	75	160	3.3	5.4
1600	155	298	,, 12	7.3	4.0	11.3	70	150	4.0	5.8
1700	177	350	,, 9.8	8.0	4.7	12.7	70	145	4.7	7.2
1800	201	407	,, 8.5	8.7	5.3	14.0	70	140	5.3	8.3
1900	227	469	,, 7.3	9.3	6.0	15.3	70	135	6.0	9.6
2000	256	541	,, 6.4	10.0	6.7	16.7	70	130	6.7	10.9
2100	288	623	,, 5.5	13.3	8.0	18.0	74	140	8.0	13.4
2200	322	715	,, 4.8	16.7	9.3	19.3	78	150	9.3	16.2
2300	360	817	,, 4.2	20.0	10.7	20.7	82	160	10.7	19.5
2400	401	929	,, 3.7	25.0	12.0	22.0	86	170	12.0	23.2
2500	447	1052	,, 3.3	30.0	13.3	23.3	90	180	13.3	27.2
2600	496	1186	,, 2.9	35.0	16.7	25.0	100	190	16.7	34.5
2700	551	1332	,, 2.6	41.7	20.0	26.7	110	200	20.0	42.3
2800	610	1491	,, 2.3	48.3	23.3	28.3	120	210	23.3	52.1

Appendix IV.—*continued.*

TABLE 2 (A). TRAJECTORY TABLE.

·303 VICKERS GUN, MARK VII AMMUNITION.

RANGE YARDS	POINT DISTANT FROM GUN IN YARDS.																		
	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000
0	·4	1·0	1·9	3·2	4·9	7·1	10·0	13·6	18·0	23·4	30·0	38·2	47·6	58·9	72·1	87·5	105	125	149
100	·2	·7	1·5	2·8	4·4	6·5	9·3	12·8	17·2	22·4	28·9	37·0	46·4	57·0	70·7	86·0	104	124	147
200	0	·4	1·1	2·2	3·7	5·7	8·4	11·8	16·0	21·1	27·6	35·5	44·8	55·9	68·9	84·0	102	121	145
300	·3	0	·6	1·6	3·0	4·9	7·5	10·7	14·8	19·8	26·2	34·0	43·1	54·5	67·0	81·6	97·5	119	142
400	·5	·5	0	·9	2·1	3·9	6·3	9·5	13·3	18·3	24·4	32·1	41·0	52·0	64·4	59·6	96·8	117	140
500	·9	·9	·6	0	1·1	2·6	4·9	7·9	11·6	16·3	22·3	29·9	38·6	45·2	61·4	76·6	93·6	113	136
600	1·2	1·4	1·3	·9	0	1·4	3·5	6·3	9·8	14·4	20·2	27·6	36·1	46·6	59·0	73·6	90·6	110	133
700	1·6	2·0	2·1	1·9	1·2	0	1·9	4·5	7·9	12·2	17·8	25·0	33·3	43·6	55·8	70·1	87·0	106	128
800	2·1	2·7	3·1	3·1	2·6	1·6	0	2·4	5·5	9·6	15·0	21·9	30·0	40·1	52·0	66·1	82·7	102	124
900	2·6	3·5	4·1	4·4	4·2	3·5	2·0	0	2·9	6·7	11·9	18·5	26·4	36·2	48·0	61·7	78·0	96·6	119
1000	3·2	4·3	5·3	5·8	5·9	5·5	4·4	2·6	0	3·5	8·7	14·7	22·4	31·8	43·2	56·9	72·8	91·1	113
1100	3·9	5·4	6·6	7·5	7·9	7·8	7·1	5·6	3·3	0	4·5	10·6	17·9	27·0	38·2	51·4	67·0	85·0	106
1200	4·6	6·5	8·1	9·3	10·2	10·3	10·1	9·0	7·1	4·2	0	5·7	12·6	21·4	32·1	45·0	60·1	78·0	98·9
1300	5·5	7·8	9·5	11·5	12·7	13·4	13·5	12·8	11.3	8·6	5·1	0	6·5	14·8	25·1	37·5	52·3	69·5	90·0
1400	6·4	9·2	11·7	13·8	15·5	16·7	17·2	17·0	16·0	13·9	10·6	6·0	0	7.9	17·7	29·6	43·9	60·7	80·8
1500	7·3	10·7	13·7	16·3	18·7	20·3	21·3	21·7	21·9	19·7	17·0	12.7	7·3	0	9·3	20·7	34·6	50·8	70·4
1600	8·7	12·7	16·0	19·3	22·0	24·3	26·0	27·0	27·0	26·0	24·0	20·4	15·3	8·7	0	10·9	24·1	39·7	58·6
1700	10·0	14·3	18·7	22·7	26·0	29·0	31·3	32·7	33·3	33·0	31·7	28·7	24·3	18·3	10·0	0	12·6	27·6	45·9
1800	11·3	16·7	21·3	25·0	30·5	33·8	36·7	39·0	40·3	40·7	40·0	37·7	34·3	28·7	21·3	12·0	0	14·3	32·0
1900	13·0	19·0	24·7	30·0	35·0	39·1	43·0	46·0	48·3	49·3	49·3	48·0	45·0	40·3	33·7	25·0	14·0	0	16·8
2000	14·3	21·3	27·7	34·0	39·7	45·0	49·7	53·3	56·7	58·3	59·3	58·7	56·7	53·0	47·3	39·3	29·0	16·0	0
2100	16·3	24·3	31·7	38·7	45·3	51·7	57·0	62·0	65·7	68·7	70·7	70·7	69·8	66·7	62·0	54·7	45·7	33·7	18·7
2200	18·3	27·3	35·7	43·7	51·3	58·7	65·0	70·7	75·7	80·0	82·7	83·7	83·7	81·7	77·7	71·7	63·3	52·3	38·3
2300	20·7	30·7	40·0	49·3	58·3	66·3	74·0	80·7	86·3	92·0	96·0	98·0	99·0	98·3	95·7	90·7	83·3	73·7	60·7
2400	23·0	34·0	45·0	55·3	65·3	74·7	83·3	91·7	99·0	105	110	114	116	116	115	111	105	96·0	84·3
2500	25·7	38·0	50·0	62·0	73·3	84·0	94·3	104	112	120	126	131	135	136	136	134	129	121	111
2600	28·7	42·7	56·3	69·3	82·3	94·3	106	117	127	136	144	150	155	158	159	158	155	149	140
2700	32·3	47·7	62·7	77·7	92·0	106	119	132	143	153	163	171	178	182	185	186	184	180	172
2800	35·3	52·7	69·7	86·3	102	118	133	147	161	173	184	194	202	209	213	215	215	212	207
L.S.	·7	1·0	1·3	1·7	2·0	2.3	2·7	3·0	3·3	4·0	4·7	5·3	6·0	6·7	7·3	8·0	8·7	9·3	10·0

RANGE YARDS	2100	2200	2300	2400	2500	2600	2700	2800
0	—	—	—	—	—	—	—	—
100	20·7	0	—	—	—	—	—	—
200	44·0	24·0	0	—	—	—	—	—
300	69·0	50·7	27·3	0	—	—	—	—
400	97·0	79·7	58·0	31·7	0	—	—	—
500	127	111	91·0	66·3	35·3	0	—	—
600	161	147	128	105	75·7	41·7	0	—
700	197	185	168	146	119	86·0	46·3	0
L.S.	13.3	16·7	20·0	25·0	30·0	35·0	41·7	—

NOTES.

The table is divided into two parts, one below the zero line and the other above. That part below the zero line is the ordinary trajectory table; that part above and the words "positive" and "negative" are for use when determining clearance in Indirect Overhead Fire. See Section 10, Notes para. vii.

PART BELOW ZERO LINE.

1.—This table gives at any distance from the gun the height IN YARDS of the centre of the cone ABOVE the line of sight. When used for clearance, line of sight is taken to be horizontal.

EXAMPLE.—At a range of 1900 yards, and at a distance of 1000 yards from the gun the centre of the cone is 48·3 yards above the line of sight.

2.—To find the height of the lowest shot above the line of sight SUBTRACT the figure in the line marked L.S. from the height of the trajectory.

EXAMPLE.—At a range of 1800 yards the lowest shot at 900 yards from the gun is 39 — 3 = 36 yards above the line of sight.

PART ABOVE ZERO LINE.

1.—This table gives at any distance from the gun the depth IN YARDS of the centre of the cone BELOW a horizontal plane passing through the gun position. When using this table the range is not the range to the target, but is the quadrant angle on the gun converted to a range by Table 1, column 2.

EXAMPLE.—At a range of 800 yards, and at a distance of 1200 yards from the gun the centre of the cone is 15 yards below the horizontal plane through the gun position.

2.—To find the depth of the lowest shot below the horizontal plane passing through the gun position ADD the figure in the line L.S. to the height of the trajectory.

EXAMPLE. — At a range of 800 yards, the lowest shot at 1400 yards from the gun is 30 plus 6 = 36 yards below the horizontal plane through the gun position.

Appendix IV.—*continued.*

TABLE 2 (B).—TRAJECTORY TABLE FOR NEGATIVE QUADRANT ANGLES.

·303 VICKERS GUN, MARK VII AMMUNITION.

Q.E. Mins.	Distance of Point from Gun in Yards.															
	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000
–5	.7	.9	1.0	1.2	1.3	1.4	1.6	1.7	1.9	2.0	2.1	2.3	2.5	2.6	2.7	2.9
–0	3.2	4.8	7.1	10.0	13.6	18.0	23.4	30.0	38.2	47.6	58.9	72.1	87.5	105	125	149
–25	6.8	9.2	12.2	15.8	20.2	25.3	31.7	39.1	47.6	57.6	69.7	83.7	99.6	118	139	163
–50	10.4	13.6	17.3	21.6	26.7	32.6	39.7	47.8	57.1	67.8	80.6	95.5	112	131	153	178
–75	14.1	17.9	22.4	27.4	33.2	39.8	47.8	56.5	66.6	78.0	91.6	107	124	144	167	192
–100	17.7	22.3	27.6	33.2	39.8	47.2	55.6	65.4	76.0	88.4	102	119	137	158	180	207
–125	21.3	26.8	32.7	38.0	46.4	54.5	63.6	74.0	85.5	98.5	113	130	149	171	194	221
–150	24.9	31.1	37.8	44.7	52.9	61.6	71.6	82.8	95.0	109	124	142	162	184	208	236
–175	28.5	35.4	42.9	50.5	59.5	68.9	79.6	91.5	104	119	135	154	174	197	222	250
–200	32.2	39.7	47.8	56.4	66.1	76.1	87.6	100	114	129	146	164	186	210	236	265
–225	35.6	44.1	52.9	62.2	72.7	83.4	95.6	109	123	139	157	177	199	223	250	279
–250	39.5	48.4	58.2	68.0	79.0	90.7	104	118	133	149	168	188	211	236	264	294
–275	42.8	52.8	63.3	73.8	85.6	98.0	112	126	142	159	179	200	224	249	277	308
–300	46.8	57.1	68.4	79.6	92.1	105	120	135	152	169	190	211	236	262	291	323
–325	50.0	61.5	73.2	85.4	98.6	113	128	144	161	180	201	223	248	275	305	
–350	54.1	65.8	78.3	91.2	105	120	136	152	171	190	212	235	261	288		
–375	57.2	70.2	83.4	97.0	112	127	144	161	180	200	223	246				
–400	61.3	74.5	88.5	103	118	134	152	170	189	210	234					
–425	65.0	78.9	93.6	109	125	142	160	179	199	220	244					
–450	68.6	83.2	98.7	115	131	149	168	189	208	230	255					
–475	72.2	87.6	104	120	138	156	176	196	218	240						
–500	75.9	92.1	109	126	145	163	184	205	227							
–525	79.5	96.5	114	132	151	170										
–550	83.1	101	119	138	158	178										

NOTES.

1.—This table gives at any distance from the gun the depth IN YARDS of the centre shot of the cone below a horizontal plane passing through the gun position.

2.—It is for use when determining clearance over our own troops' heads in indirect overhead fire.

3.—The line Q.E. = — 5 means that at 1000 yards, for instance, each addition of 5 minutes to the Q.E. adds 1·5 yards to the depth of the trajectory,

EXAMPLE.

Q.E. = — 265 minutes; range = 1400 yards. Trajectory depth below horizontal plane = 149 plus 2 yards for each 5 minutes added above 250.

= 149 + ($\frac{15}{5}$ × 2) = 155.

range-takers and instruments."

Appendix IV.—*continued.*

Table 3 (A).—The Quadrant Angle in Minutes, knowing Range and V.I. ·303 Vickers Gun, Mark VII. Ammunition.

Target ABOVE Gun.

V.I. in Yards.	Range to Target in Yards.																								
	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800
1	7	6	5	4	4	3	3	3	3	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1
5	56	57	60	65	71	79	89	100	114	129	147	166	187	211	236	265	296	330	368	408	454	503	557	616
10	91	85	84	86	90	96	104	115	127	142	158	177	197	220	245	273	304	338	375	415	461	509	564	622
15	125	114	109	108	109	114	120	129	141	154	169	187	207	230	254	282	313	345	382	423	468	516	570	628
20	160	143	133	129	129	131	136	143	154	166	181	198	218	239	263	290	321	353	390	430	475	522	577	635
25	194	171	158	151	148	148	151	158	167	178	192	209	228	249	272	299	329	361	397	437	481	529	583	641
30	228	200	183	172	167	165	167	172	181	191	204	220	238	258	231	308	337	369	405	444	488	536	589	647
35	263	229	207	194	186	183	183	186	194	203	215	230	248	268	291	316	345	377	412	451	495	542	596	653
40	297	258	232	215	205	200	198	201	207	215	227	241	258	278	300	325	354	385	420	458	502	549	602	659
45	332	286	256	237	224	217	214	215	220	228	238	252	268	287	309	334	362	392	427	465	509	556	608	665
50	366	315	281	258	243	234	229	229	233	240	250	263	278	297	318	342	370	400	435	473	516	562	615	672
55	400	344	305	279	262	251	245	244	247	252	261	273	288	306	327	351	378	408	442	480	523	569	621	678
60	435	372	330	301	281	268	261	258	260	265	273	284	299	316	336	359	386	416	450	487	530	576	628	684
65	469	400	354	323	300	285	276	272	273	277	284	295	309	325	345	368	394	424	457	494	537	582	634	690
70	503	429	379	344	319	303	292	287	286	289	296	306	319	335	353	376	402	432	465	501	544	589	640	696
75	538	458	403	366	338	320	307	302	300	302	307	316	329	344	362	385	411	440	472	509	550	596	646	703
80	572	486	428	387	358	337	323	317	313	314	319	327	339	354	372	394	419	448	480	516	557	603	652	709
85	606	515	452	408	377	354	339	331	327	327	330	338	349	363	381	403	427	456	487	523	564	609	659	715
90	641	544	477	429	396	371	354	346	340	339	342	348	359	373	390	411	436	464	495	530	571	616	665	721
95	675	572	502	451	415	389	370	360	353	351	353	359	369	383	399	420	444	471	502	538	577	622	671	727
100	708	602	526	472	434	406	386	375	366	363	364	370	379	392	408	429	452	479	510	545	584	629	678	733

NOTES.

1.—This table combines the angle of sight with the angle of tangent elevation, thereby producing the quadrant angle directly.
2.—It is used as follows:—Range = 1000 yards. Target 55 yards above gun. Quadrant elevation = 327 minutes.
3.—The top line where V.I. = 1 yard is used as follows:—EXAMPLE I: Range = 1000, V.I. = 57 yards. The quadrant elevation for range = 1000 and V.I. = 55 is 327 minutes. For each extra yard of V.I. the top line shows that 2 minutes must be ADDED. Therefore necessary quadrant angle is 327 plus (2 × 2) = 331 minutes.

Table 3 (B).—The Quadrant Angle in Minutes, knowing Range and V.I. ·303 Vickers Gun, Mark VII. Ammunition.

Target BELOW Gun.

V.I. in Yards.	Range to Target in Yards.																								
	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800
1	7	6	5	4	4	3	3	3	3	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1
5	-12	-1	10	21	33	45	57	72	88	105	123	144	167	191	218	248	280	314	352	394	440	489	545	604
10	-47	-29	-14	0	14	28	42	57	75	92	112	133	157	182	209	239	272	306	345	387	433	483	538	598
15	-81	-58	-39	-22	-5	10	26	43	61	80	101	123	147	172	200	230	263	299	338	379	426	476	532	592
20	-116	-87	-64	-43	-25	-7	10	29	48	68	89	112	136	163	191	222	245	291	330	372	420	470	525	585
25	-150	-115	-88	-65	-44	-24	-5	14	35	50	78	101	125	153	182	213	247	283	323	365	413	463	519	579
30	-184	-144	-113	-86	-63	-41	-21	0	21	43	66	90	116	144	173	204	239	275	315	358	406	456	513	573
35	-219	-173	-137	-108	-82	-59	-37	-14	8	31	55	80	106	134	164	196	231	267	308	351	399	450	506	567
40	-253	-202	-162	-129	-101	-76	-52	-29	-5	19	43	69	96	124	155	187	222	259	300	344	392	443	500	561
45	-288	-230	-186	-151	-120	-93	-68	-43	-18	6	32	58	86	115	146	178	214	252	293	336	385	436	494	555
50	-322	-259	-211	-172	-139	-110	-83	-57	-31	-6	20	47	76	105	137	170	206	244	285	329	378	430	487	548
55	-357	-288	-235	-193	-158	-127	-99	-72	-45	-18	9	37	66	96	128	161	198	236	278	322	371	423	481	542
60	-391	-316	-260	-215	-177	-144	-115	-86	-58	-31	-3	26	55	86	119	153	189	228	270	315	364	416	474	536
65	-425	-344	-284	-237	-197	-161	-130	-100	-71	-43	-14	15	45	77	110	144	181	220	263	308	358	410	468	530
70	-460	-372	-309	-258	-216	-179	-146	-115	-84	-55	-26	5	35	67	101	136	173	212	255	301	351	403	462	524
75	-495	-401	-333	-280	-235	-196	-161	-129	-97	-67	-37	-6	25	57	92	128	166	206	248	294	344	397	456	518
80	-529	-430	-358	-301	-254	-214	-177	-144	-111	-79	-48	-17	15	48	82	119	158	199	240	287	337	391	449	512
85	-563	-459	-382	-323	-273	-231	-192	-158	-124	-92	-60	-28	5	38	73	111	149	191	233	280	330	384	443	506
90	-598	-488	-407	-344	-292	-248	-208	-172	-137	-104	-71	-39	-5	29	64	102	141	183	225	273	323	378	436	500
95	-632	-517	-431	-366	-311	-265	-223	-186	-150	-117	-83	-50	-15	19	55	93	132	175	218	266	316	371	430	494
100	-666	-545	-456	-387	-330	-282	-239	-200	-163	-129	-94	-60	-25	10	46	85	124	167	210	259	310	365	424	488

NOTES.

1.—This table combines the angle of sight with the angle of tangent elevation, thereby producing the quadrant angle directly.
2.—It is used as follows:—Range = 1900 yards. Target 55 yards below gun. Quadrant elevation = 128 minutes.
3.—The top line where V.I. = 1 yard is used as follows:—EXAMPLE I: Range = 1900 yards. Target 57 yards below gun. The quadrant angle for range = 1900 and V.I. = 55 is 128 minutes. For each extra yard of V.I. the top line shows that 2 minutes must be SUBTRACTED. Therefore necessary quadrant angle is 128 − (2 × 2) = 124 minutes. EXAMPLE II: Range = 1300 yards, V.I. = 38 yards, Q.E. = 8 − (3 × 3) = − 1 minute. EXAMPLE III: Range = 1100 yards, V.I. = 47 yards, Q.E. = − 68 − (2 × 3) = − 74 minutes.

range-takers and instruments."

Appendix IV.—*continued.*

TABLE 4.—ATMOSPHERIC ALLOWANCE (in minutes).

NORMAL RANGE.		1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	
HEAD WINDS ADD — REAR WINDS DEDUCT.	M.P.H. 5	0	1	1	1	2	2	2	2	3	4	5	6	7	8	10	12	15	17	22	10
	10	1	1	2	2	3	4	4	4	6	8	9	11	14	17	20	24	30	37	44	15
	15	1	2	3	3	4	6	6	6	9	11	13	17	22	27	30	37	44	58	67	20
	20	2	2	4	4	5	8	8	9	13	15	17	23	29	34	40	49	60	75	89	25
	25	2	3	4	5	6	10	10	12	16	19	24	29	36	43	50	61	75	92	112	30
	30	3	4	5	6	8	12	12	16	19	23	30	35		51	61	73	91	109	136	35
	35		4	6	7	11	14	14	19	24	27	35	40	50	59	70	87	107	119	167	
																					M.P.H. × $\frac{3}{2}$ = FEET per SECOND.
BAROMETER ABOVE 30" ADD.	30·2"	0	0	1	1	1	1	2	2	2	3	3	3	4	4	5	5	5	6	6	
	30·4"	0	1	1	1	2	2	3	3	4	5	6	7	8	9	10	12	15	16	20	
	30·6"	1	1	2	2	3	3	4	4	5	6	8	9	11	13	14	17	20	22	25	
	30·8"	1	1	2	3	3	4	5	5	6	8	11	12	14	17	20	23	25	29	33	
	31·0"	1	2	3	3	4	5	6	7	8	10	13	15	17	20	23	28	30	34	39	
																					BELOW 30" DEDUCT.
TEMPERATURE (FAH.) ABOVE 60° DEDUCT.	65°	0	1	1	1	1	1	2	2	2	3	3	3	4	4	5	6	8	8	9	
	70°	1	1	2	3	3	3	4	4	5	6	7	8	10	12	14	18	22	23	28	
	75°	1	2	2	4	4	5	6	6	7	9	11	13	16	18	20	25	30	33	36	
	80°	2	2	3	4	5	6	8	8	9	11	14	16	20	23	25	33	36	41	44	
	90°	3	3	4	5	6	7	9	9	11	13	16	19	24	27	30	36	41	48	52	
	95°	3	4	5	6	7	8	9	11	13	15	18	21	27	30	36	42	48	55	60	
	100°	4	5	6	7	8	10	11	13	15	17	21	24	31	35	42	49	55	63	70	
	105°	5	6	7	8	9	11	12	14	16	19	23	27	34	39	46	54	62	70	78	
	110°	6	7	8	9	10	12	13	16	18	21	25	30	37	43	50	59	68	78	85	
	115°	6	7	9	10	11	13	15	17	20	23	28	32	40	46	54	63	74	85	93	
	120°	7	8	10	11	12	14	16	18	22	25	30	35	43	50	59	68	81	93	102	
																					BELOW 60° ADD.

NOTE.—Normal atmospheric conditions = still air. Barometer 30". Temperature 60°F.
Convert Oblique Winds and thus get the equivalent Head and Rear Wind by Appx. 4, Table 5.

EXAMPLE:—Map Range 2400 yds. (QE.401"). Wind 15 M.P.H. "Head." Barom. 29·6". Temp. 50°F. To get corrected QE. =
(1) Find 2400 yds. in column "Normal Range." (2) Find necessary allowance for Head Wind 15 M.P.H. = + 30".
(3) Find allowance for Barom. 29·6" = −7". (4) Find necessary allowance for Temp. 50°F. = + 10".
(5) + 30" − 7" + 10" = + 33". (6) ADD 33" to 401" = 434" Corrected QE.

FIGURE 4. Reinforced Concrete Machine Gun Emplacement

Appendix IV.—*continued.*

TABLE 5.—LATERAL WIND ALLOWANCES.

Range Yards	Mild 10 M.P.H.		Fresh 20 M.P.H.		Strong 30 M.P.H.	
	Yards	Minutes	Yards	Minutes	Yards	Minutes
500	1	5	1½	10	2	15
1000	3	10	6	20	9	30
1500	6	15	12	30	18	45
2000	12	20	24	40	36	60
2500	24	30	48	60	72	90

OBLIQUE WIND ALLOWANCES.

Angle of Wind with Line of Fire	Ratio of Wind affecting Elevation	Ratio of Wind affecting Direction
10° } 20° }	1	¼
30° } 40° }	¾	½
50° } 60° }	½	¾
70° } 80° }	¼	1

TABLE 6.—TIME OF FLIGHT.

Time of Flight in Seconds.	Distance Traversed in Yards.
1	600
2	1000
3	1300
4	1550
5	1775
6	1950
7	2100
8	2225
9	2350
10	2450
11	2550
12	2625
13	2700
14	2775
15	2840

Appendix IV.—*continued.*

TABLE 7.

SEARCHING REVERSE SLOPES.

.303 VICKERS GUN. MARK VII. AMMUNITION.

All Figures represent Yards.

1	2	3	4	5	6	7	8	9	10	11	12	Gun Above or Below Crest	12	11	10	9	8	7	6	5	4	3	2	1
1500	1600	1650	1700	1850	1850	1900	1950	2000	2000	2050	2100		1900	1800	1700	1600	1500	1400	1400	1350	1300	1300	1300	1200
1350	1400	1500	1600	1650	1700	1800	1850	1900	1950	2000	2050	0	2050	2000	1950	1900	1850	1800	1700	1650	1600	1500	1400	1350
1400	1450	1550	1600	1700	1750	1800	1850	1900	1950	2000	2050	10	2000	1950	1900	1850	1800	1750	1650	1600	1550	1450	1300	1150
1450	1500	1550	1650	1700	1750	1850	1900	1950	2000	2050	2100	20	2000	1950	1850	1800	1700	1650	1600	1550	1450	1350	1200	
1500	1500	1600	1650	1750	1800	1850	1900	1950	2000	2050	2100	30	1950	1900	1850	1750	1650	1600	1550	1500	1400	1250	1100	
1500	1550	1650	1700	1750	1800	1900	1950	1950	2000	2050	2100	40	1900	1850	1800	1700	1600	1500	1450	1450	1300	1150		
1550	1600	1700	1700	1800	1850	1900	1950	2000	2050	2100	2100	50	1900	1850	1750	1650	1550	1450	1400	1350	1200			
1600	1650	1700	1750	1800	1850	1950	2000	2000	2050	2100	2150	60	1850	1800	1700	1600	1450	1400	1350	1300				
1650	1650	1750	1750	1850	1900	1950	2000	2050	2100	2150	2150	70	1800	1750	1650	1550	1400	1300	1300	1700				
1650	1700	1800	1800	1850	1900	1950	2000	2050	2100	2150	2150	80	1750	1750	1650	1500	1350	1250	1250					
1700	1750	1800	1800	1900	1950	2000	2050	2050	2100	2150	2200	90	1750	1700	1600	1450	1250	1150						
1750	1800	1850	1850	1950	1950	2000	2050	2100	2150	2200	2200	100	1700	1650	1550	1400	1200	1100						
1800	1850	1900	1900	1950	2000	2050	2100	2100	2150	2200	2200	110	1650	1600	1500	1350	1150							
1850	1850	1900	1950	2000	2000	2050	2100	2100	2150	2200	2200	120	1600	1550	1450	1300	1100							
1850	1900	1950	1950	2000	2050	2050	2100	2150	2200	2250	2250	130	1600	1550	1450	1250								
1900	1950	1950	2000	2050	2050	2100	2150	2150	2200	2250	2250	140	1550	1500	1400	1200								
1900	2000	2000	2050	2050	2100	2100	2150	2150	2200	2250	2250	150	1500	1450	1350	1150								
	2000	2050	2050	2100	2100	2150	2200	2200	2250	2300	2250	160	1450	1400	1300									
		2050	2100	2150	2150	2150	2200	2200	2250	2300	2300	170	1400	1350	1250									
			2100	2150	2150	2200	2200	2250	2250	2300	2300	180	1400	1350										
					2200	2200	2250	2250	2300	2300	2350	190	1350	1300										

NOTES.

1.—The top horizontal line is the drop IN YARDS in the first 100 yards beyond the crest. The horizontal line directly below it is the distance to measure back from the crest to find gun position.

NOTE.—The crest may be taken as being either the highest point of the ground, or, in the case of a flat-topped hill, the point at which a gentle slope changes to a more abrupt one.

2.—EXAMPLE.—The ground drops 7 yards in 100, and assume also that the gun is below the crest. The left-hand side of the table must therefore be used. The table shows that for a drop of 7 yards we must go back 1900 yards from the crest. At this point, say, the gun position is found to be 90 yards below the crest. Final range, therefore, equals 2000 yards. Place the gun at this point.

3.—When the gun is in position, fire should be directed on the crest, elevation and direction being put on by any of the usual methods for indirect fire. In the example given above, the quadrant angle is that for a V.I. of 90 yards and a range of 2000 yards—*i.e.*, 41 minutes. See Table 3 (A).

4.—Searching should be employed away from the crest, but it must be remembered that as the cone is beating falling ground the length of the zone will be very much increased; therefore the turns of the wheel should be few in number.

5.—If the final position is not suitable, the gun should be moved further away from—not nearer to—the crest.

6.—If it be desired to engage an area of ground which lies some distance back from the crest, without searching back from the crest itself, the position of the gun must be determined with reference to the crest as detailed above. Then the quadrant elevation

APPENDIX V.

No. 1.

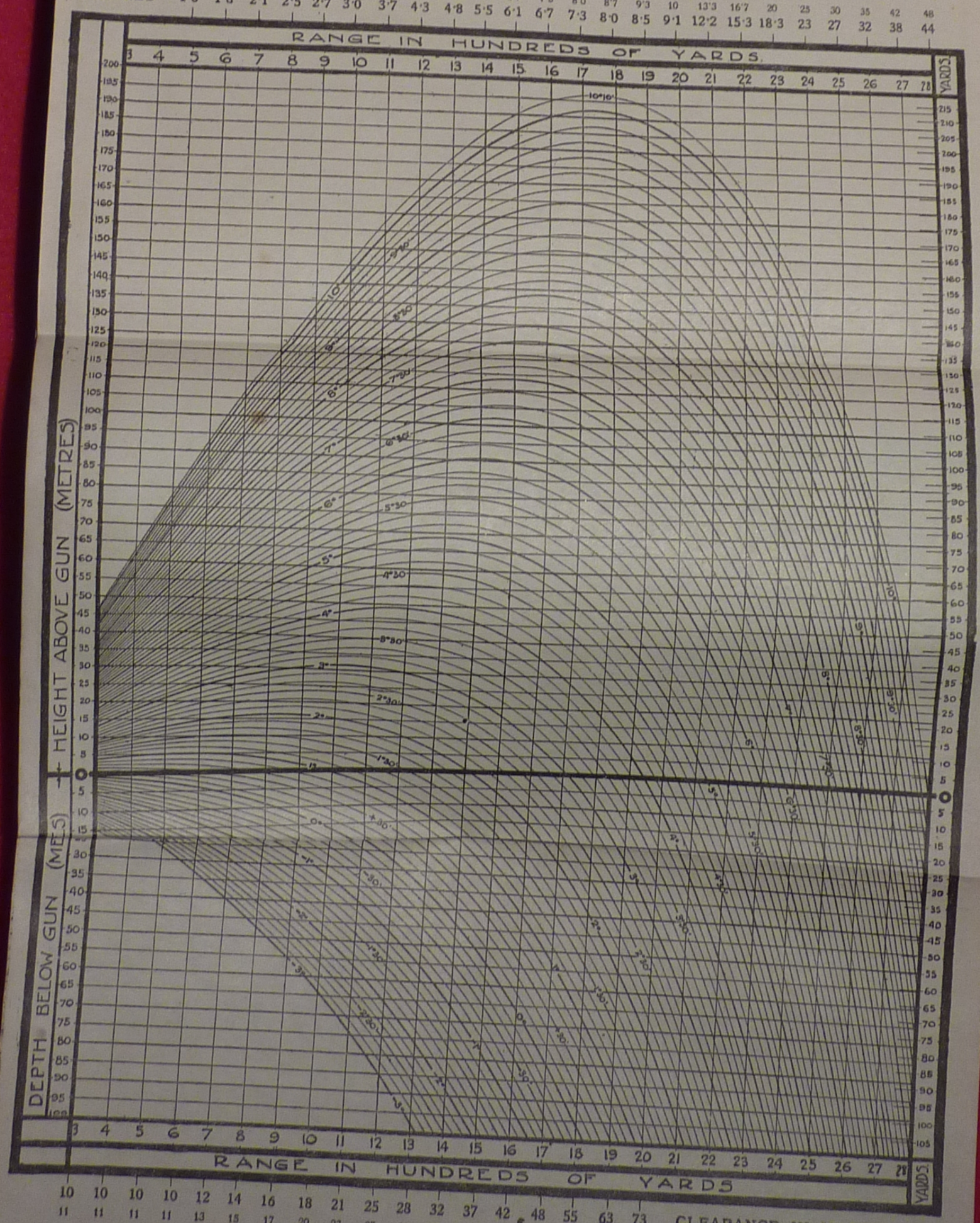
GRAPH FOR CALCULATING QUADRANT ELEVATION AND CLEARANCES.

(CURVES REPRESENT CENTRE SHOTS.)

DEPTH OF LOWEST SHOT BELOW CENTRE OF CONE AT VARIOUS DISTANCES FROM GUN.

IN YARDS .. 1·7 2·0 2·3 2·7 3·0 3·3 4·0 4·7 5·3 6·0 6·7 7·3 8·0 8·7 9·3 10 13·3 16·7 20 25 30 35 42 48

IN METRES 1·6 1·8 2·1 2·5 2·7 3·0 3·7 4·3 4·8 5·5 6·1 6·7 7·3 8·0 8·5 9·1 12·2 15·3 18·3 23 27 32 38 44



MINIMUM CLEARANCES REQUIRED AT VARIOUS DISTANCES FROM GUN.

HOW TO USE THE GRAPH.—TO FIND Q.E.: Take range and run up on vertical scale to height of target above or below gun. The curve cutting this point gives required Quadrant Elevation.

TO FIND CLEARANCE.—Follow this curve along, and ascertain at what height it passes vertically above a point plotted to show distance and height (above or below gun) of own troops (or obstruction). This gives clearance in yards (right-hand scale), or metres (left-hand scale), from centre shot to ground.

FIGURE 4.—Reinforced Concrete Machine Gun Emplacement.

No. 2.

GRAPH of TRAVERSES, etc,

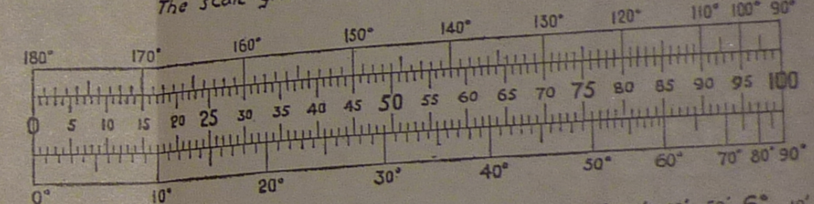
(IN YARDS OR METRES AND DEGREES)

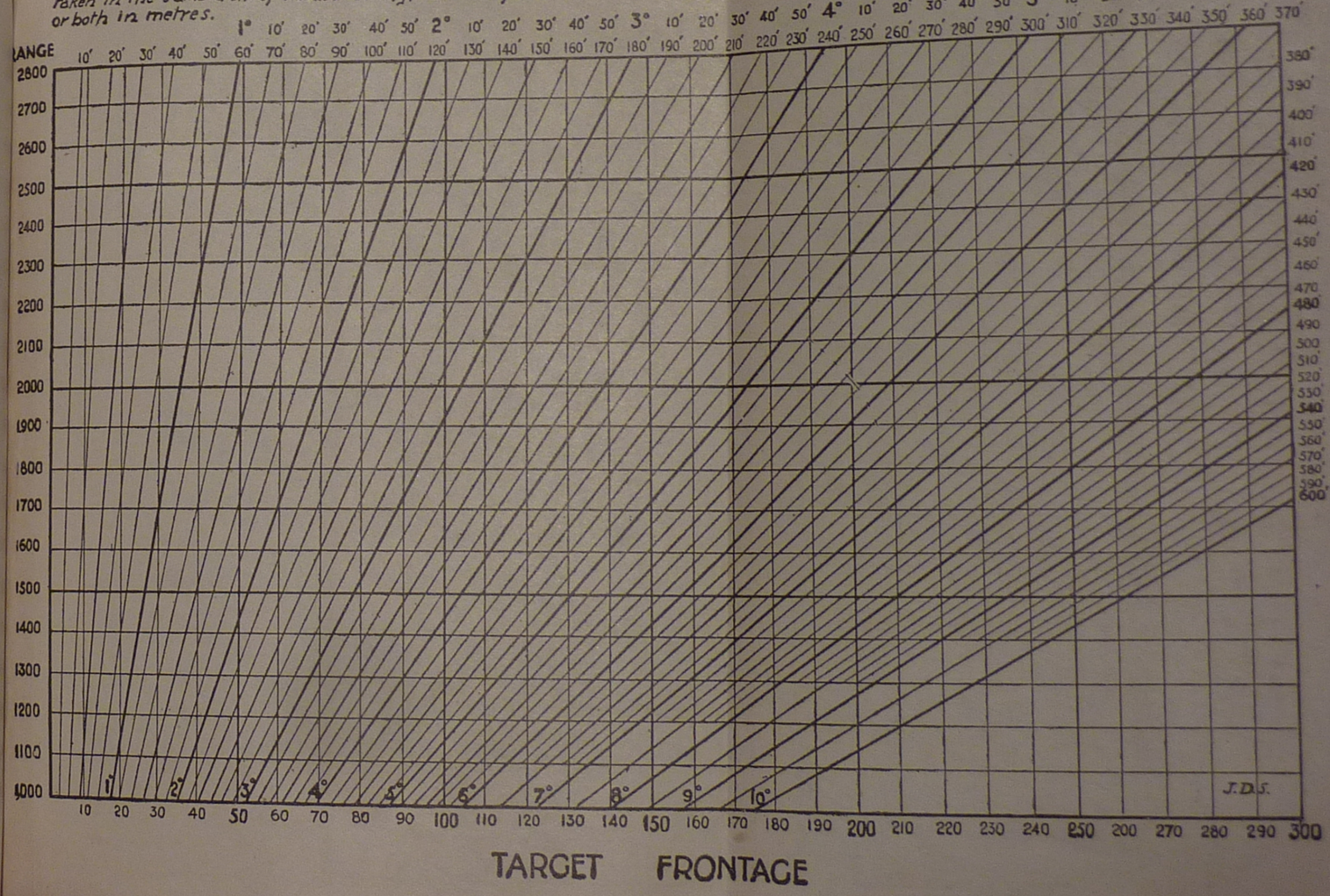
The Angle is shewn by the diagonal line nearest to the point of intersection of the required Target-Frontage line (vertical) and the (horizontal) Range line.

Note:— Both Target Frontage and Range must be taken in the same unit of measure: e.g. both in yards or both in metres.

SCALE for the conversion of OBLIQUE to equivalent FRONTAL TARGETS.

EXAMPLE:— *Target 280" long at an angle of 150° to line of fire.*
The scale gives .45 so equivalent frontal target = .45 of 280" = 126"





APPENDIX VI. No. 1.

INDIRECT OVERHEAD FIRE SHEET.

No.....M.G. Co. No.....Section. Date..... Map used.....

Elevation								Clearance						
Gun position	Map location	Target	Map location	Direction	Range to Target	Contours: Gun	Contours: Target	V.I. + or V.I. −	Q.E. Table 3 (A) or 3 (B)	Range for Q.E. Table 1, Col. 1 and 2	Contour of own Troops	V.I. between Gun and own Troops	Range to own Troops	Trajectory Height Table 2 (A) or 2 (B)	Clearance obtained	Table of Safety Clearances
																600 − 11 × 700 − 13 × 800 − 15 × 900 − 17 × 1000 − 20 × 1100 − 23 × 1200 − 27 × 1300 − 31 × 1400 − 35 × 1500 − 40 × 1600 − 46 × 1700 − 53 × 1800 − 60 × 1900 − 69 × 2000 − 80 ×
																Grid bearing of Zero Line

...makers and instruments."

Appendix VI.—*continued.* No. 2.

Ref.: 1/1000.

BATTERY CHART. D. Battery.

Place:
Date:

Composition No. 3 and 4 Sections No. M.G.C. Frontage of Battery 70 yards.

Commanded by:

Grid Bearing to R.O. 31° 30'

Location of Directing Gun 7d. 50°. 23.

Zero Line 7d. 50. 23. through 6a 1.5.

No. of Directing Gun. No. 8

Grid Bearing of Zero Line 290° 30'

TASK:—
Creeping Barrage, move forward to advanced battery position. D.2.

No. of Barrage	No. of Guns	Targets	Clock Times	Zero Time	Angle of Switch.	Distribution Angle	Range	V.I.	Q.E.	Range to F.T. when Barrage Lifts	Clearance when Barrage Lifts	Rate of Fire
A	1 to 8	2c 1.1. to 6a 1.5.		Z to Z + 2	0°	50′	1800	−8x	3° 5′	1150x	39x	75 R.P.M.
B	1 to 8	1d 7.1. to 5b 7.5.		Z + 3 to Z + 5	1° 30′ L	50′	2000	−10x	4°	1250x	58x	75 R.P.M.
C	1 to 8	1d 3.1. to 5b 3.5.		Z + 6 to Z + 8	3° L	40′	2200	−5x	5° 14′	1350x	87x	75 R.P.M.

	8	7	6	5	4	3	2	1
A	0°	50′ R	1′ 40 R	2° 30′ R	3° 20′ R	4° 10′ R	5° R	5° 50′ R
B	1° 30′ L	40′ L	10′ R	1° R	1° 50′ R	2° 40′ R	3° 30′ R	4° 20′ R
C	3° L	2° 20′ L	1° 40 L	1° L	20′ L	20′ R	1° R	° 40′ R

REMARKS.

This shews angle of Deviation from Zero Line for each gun. From this Table a Barrage Chart for each gun is compiled and issued to Gun Commanders.

*To get parallel lines all guns 101° 30′ Left. (NOTE:—The R.O. was in line with the guns).

Appendix VI.—*continued.* No. 3.

GUN CHART.

No. 1 Gun. D. Battery. Gun Commander:—

Grid Bearing of Zero Line 290° 30′

No. of Barrage	Clock Time	Zero Time	Angle from Zero Line	Q.E.	Traverse	Rate of Fire
A		0 to 2	5° 50′ R	3° 5′	2°	75 R.P.M.
B		3 to 5	4° 20′ R	4°	2°	75 R.P.M.
C		6 to 8	1° 40′ R	5° 14′	2°	75 R.P.M.

Chart of Concentration Points.

No. of Point	Angle from Zero Line	Q.E.	REMARKS
1	5° LEFT	6° 30′	Strong Point 5b 2.2.
2			
3			

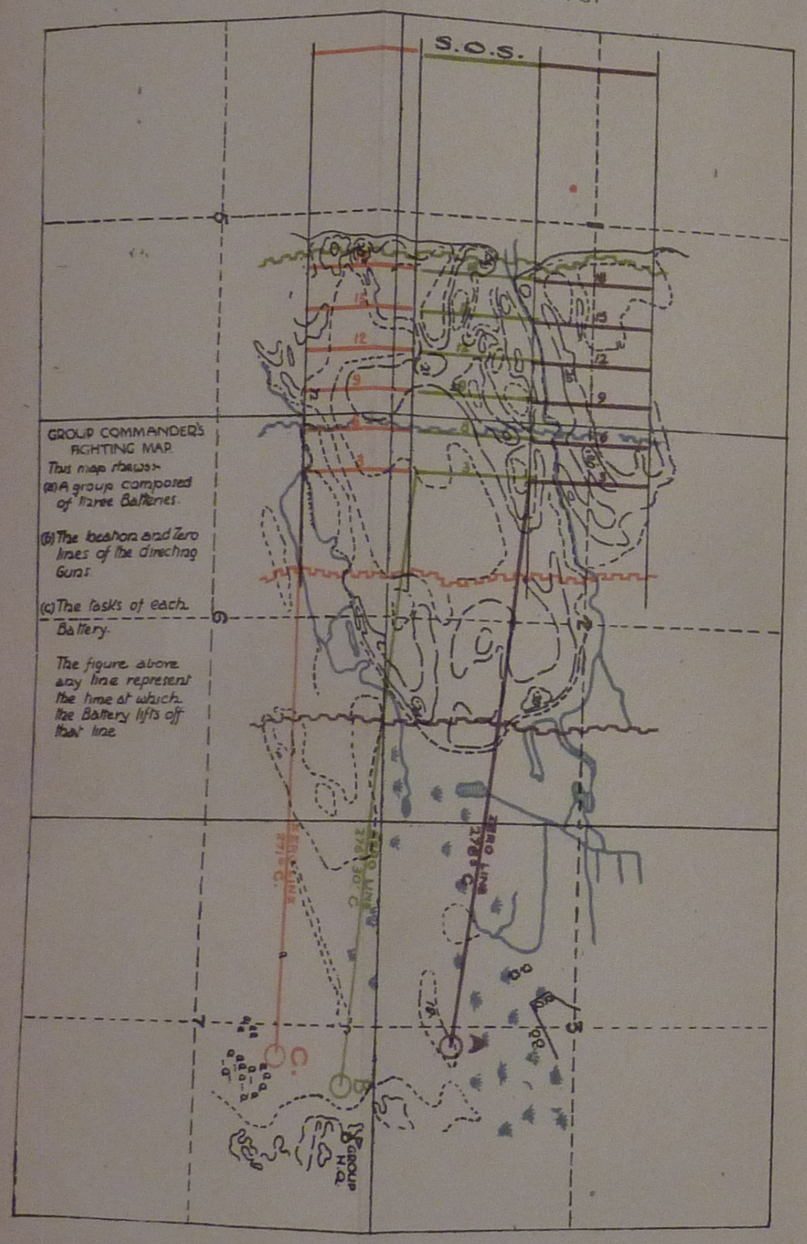
FIGURE 4. Reinforced Concrete Machine Gun Emplacement

Range-takers and instruments."

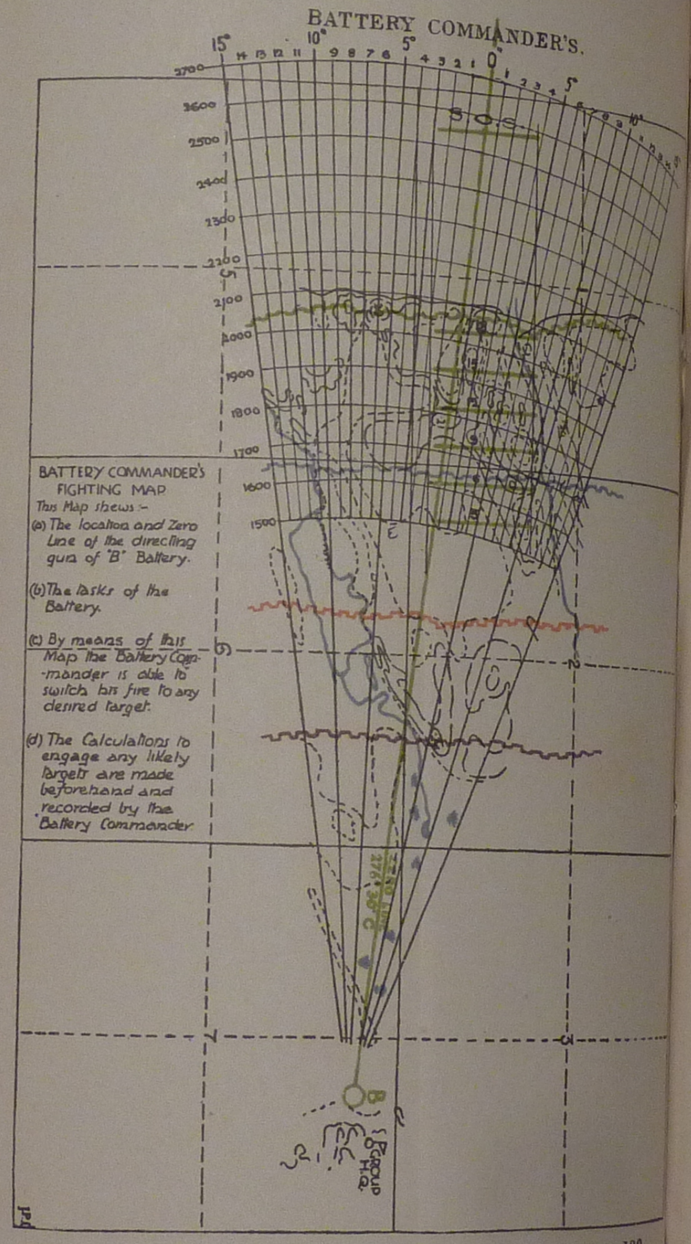
APPENDIX VII.

FIGHTING MAPS.

GROUP COMMANDER'S.



BATTERY COMMANDER'S.



To face page 122.

FIGURE 4.—Reinforced Concrete Machine Gun Emplacement.

APPENDIX VIII.

COMPASS TOWER.

Description.

The "Compass Tower," shown in the accompanying photograph has been designed for the purpose of laying the gun quickly and accurately on any given bearing by direct use of the Compass.

Experiments showed that the iron of the tripod did not affect the readings of a compass placed directly above the socket at a height of not less than 14 inches (the gun having been removed).

The pattern of tower illustrated is constructed of wood (mahogany). It is held upright by the crosshead joint pin to which it can be clamped by means of a wing nut. On the table forming the top of the instrument, a compass can be placed and held from moving by a leaf spring; the latter projects up through a hole in the table and presses the compass case against two round-headed screws.

The crosshead joint pin makes an angle of 90° with the axis of the bore, and the compass can be adjusted rapidly by means of an adjustable sight vane on the table, so that the line of sight through the compass is at right angles to the crosshead joint pin, and therefore parallel to the axis of the bore.

The overall length of this model is 16 inches; width 2¼ inches; weight 12 ounces.

Method of use.

To adjust: Lay the gun on some distant object, and tighten the traversing clamp securely. Remove the gun from the crosshead to a distance of at least three yards.

Place the compass tower in position on the crosshead, replace the crosshead joint pin, and clamp the tower in position by means of the clamping nut.

Place the compass on the table, and align it on the object by rotating the compass. Bring the sight vane of the compass tower into alignment with the hair line of the compass, and then clamp up the sight vane.

The compass tower will now be in adjustment.

To lay the gun on any magnetic bearing: Remove the gun from the vicinity of the tripod, and loosen the traversing clamp; place the compass tower on the crosshead, and align the hair line of the compass on the slit of the compass tower sight vane.

Rotate the crosshead until the required reading is seen on looking through the compass prism (or its equivalent).

Clamp up the traversing clamp; loosen slightly the clamping nut of the compass tower, and withdraw the crosshead joint pin. Remove the compass tower from the crosshead, and replace the gun which will now be pointing in the required direction.

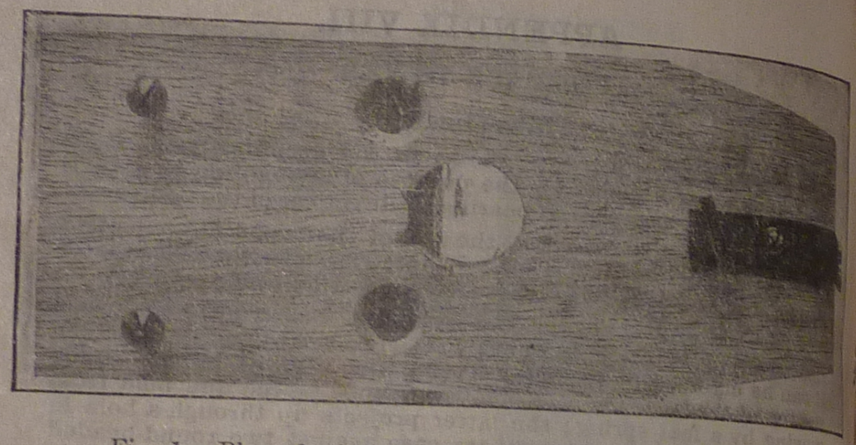


Fig. 1.—Plan of table of Compass Tower viewed from above.

Fig. 2.—Perspective view of Compass Tower in position on the crosshead, compass in position.

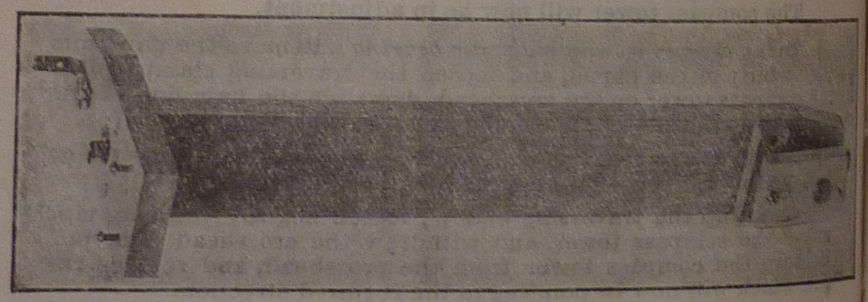
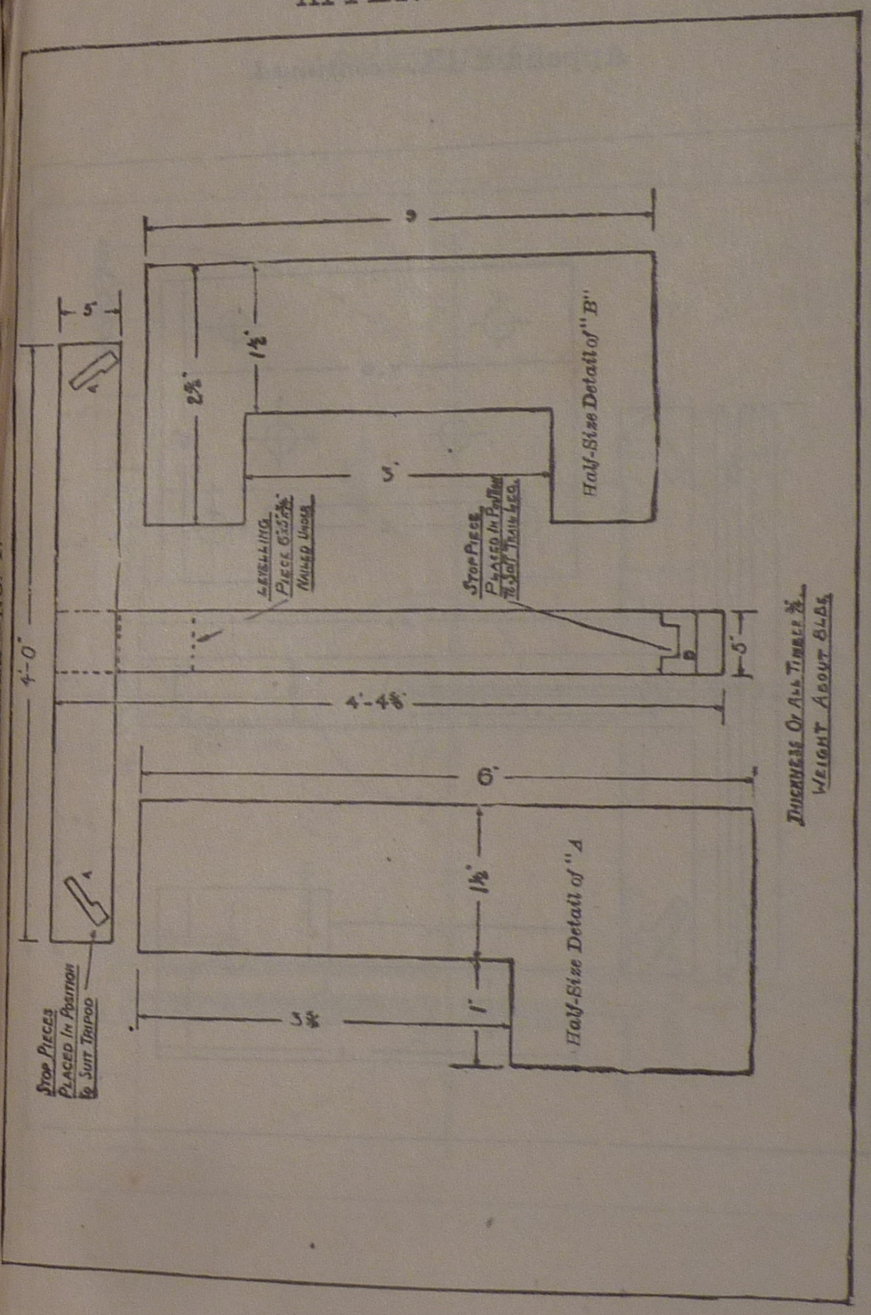


Fig. 3.—Perspective view of Compass Tower showing table, sight vane, and securing clip.

FIGURE 4.—Reinforced Concrete Machine Gun Emplacement.

APPENDIX IX.



T BASES.—No. 2.

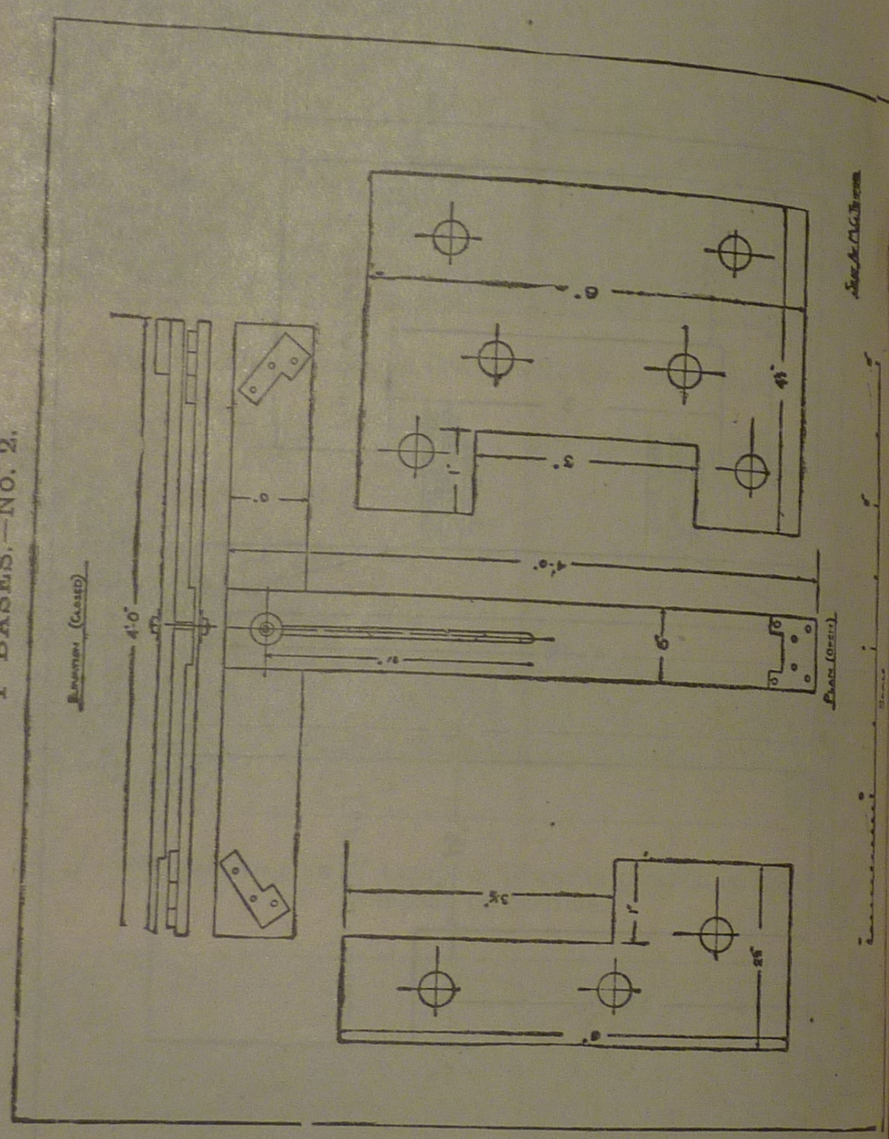
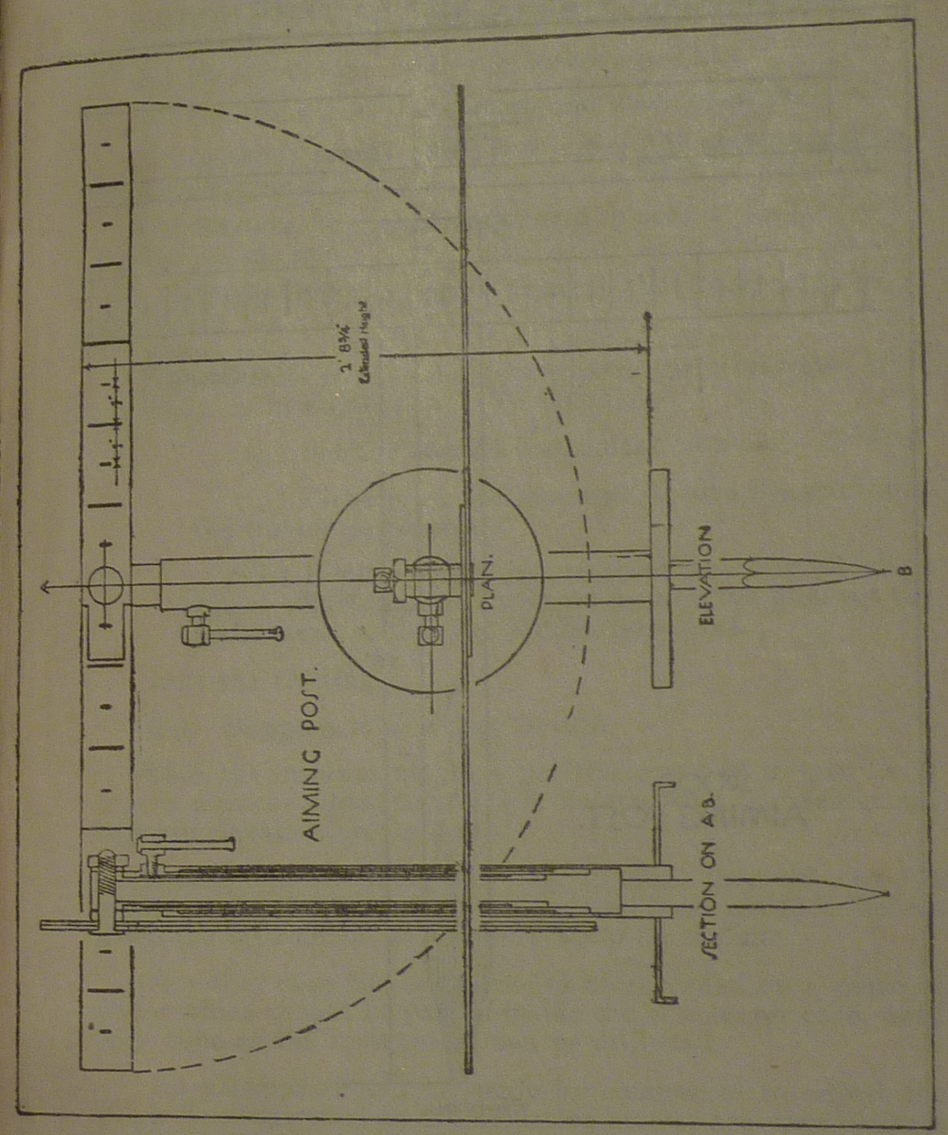


FIGURE 4.—Reinforced Concrete Machine Gun Emplacement

APPENDIX X.



AIMING MARKS.—No. 1a.

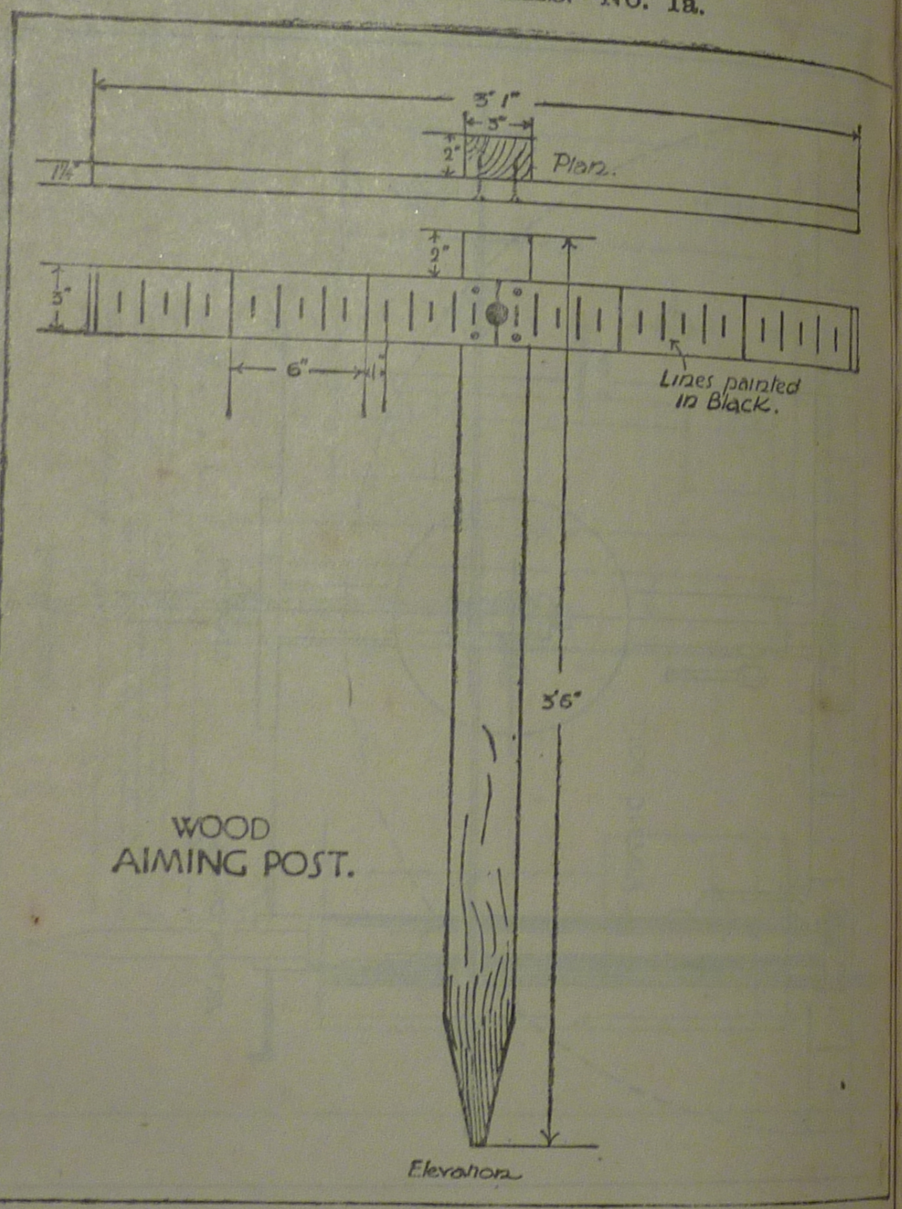


FIGURE 4.—Reinforced Concrete Machine Gun Emplacement.

APPENDIX XI.

ADJUSTMENT OF THE MARK V. CLINOMETER.

(i.) Mount the gun with the socket upright.

(ii.) Set the clinometer to zero and place it on the gun.

(iii.) Without touching the gun move the elevating wheel until the bubble is central.

(iv.) Reverse the clinometer and place it in the same position on the gun.

(v.) If the bubble is still central the instrument is in adjustment.

If the bubble is not central, compare the clinometer with one which is in adjustment. To do this—

(i.) Set the correct instrument to 2 deg.

(ii.) Place it on the gun and elevate the gun until the bubble is central.

(iii.) Replace the clinometer by the one which is out of adjustment and without moving the gun, set the instrument so that the bubble is central.

Take the reading.

E.g. Suppose it is 2 deg. 10 min.

Then the instrument has a positive error of 10 min., and 10 min. must be added to any Q.E. before using the instrument to place elevation on the gun.

Again, if the reading is 1 deg. 50 min., then the error is negative and 10 min. must be subtracted from any Q.E. before using the instrument to place elevation on the gun.

In either case the error should be recorded on a piece of paper which should be pasted inside the clinometer case, until such time as the instrument can be adjusted.

No attempt should be made by companies to adjust the Mark V. clinometer, as the adjusting screws are very delicate and the adjustment should be done in workshops.

FIGURE 4.—Reinforced Concrete Machine Gun Emplacement.
(For Two Guns.)

APPENDIX XII.

CARE OF MACHINE GUNS IN FROSTY WEATHER.

1. Not more than about 5 pints of water should be put into the barrel casing, and 20 per cent. of glycerine will prevent it from freezing quickly. In extremely hard weather, if the gun has to be exposed, experience has proved that $2\frac{1}{2}$ pints of water plus $2\frac{1}{2}$ pints of pure or residue glycerine is necessary. A drawback, however, to the large proportion of glycerine is that if fire is sustained until the mixture boils very bad fumes are given off. If the gun is used in a covered emplacement these fumes have more effect upon the team than the fumes given off by cordite.

2. Working parts should be slightly oiled with a lightly oiled rag. If firing is sustained oil must be applied to all frictional parts.

3. Guns should be wrapped in blankets, sandbags or rope, etc., and kept near braziers or in men's dug-outs or close to the body till required. If none of these courses is possible, the recoiling portions should be frequently worked, or single shots fired and the lock be changed at interals, the spare lock being kept in a clean pocket close to the body.

4. A proportion of ammunition should, if possible, be kept warm and changed at intervals.

5. If possible, some oil should be kept warm for use if firing is prolonged.

6. Should the water in the barrel casing become frozen solid, on the gun being fired the barrel will probably not recoil far enough to work the gun and will remain back. To remedy this, pull the crank handle on to the roller, then bring it back to a vertical position and force the barrel to the front, pulling the belt if necessary; let the crank handle return to the check lever and fire the gun. This should be repeated until the barrel recoils correctly.

7. If a gun is exposed in extremely hard weather, fuzee and other springs become brittle, and lose their quickness. Fuzee springs should be lightened, as the frost tends to increase their weight.

—/603

APPENDIX TO ARMY INSTRUCTION (INDIA) No.980 of 1925.

DESCRIPTION AND INSTRUCTIONS FOR USE OF ATTACHMENTS TO VICKERS .303 inch MACHINE GUNS FOR AUTOMATIC FIRING OF S. A. BLANK AMMUNITION.

Special details:-

Barrel, Mark II, "D.P.B.".
Cone, front, muzzle attachment, blank.
Cup, muzzle attachment, blank.
Nut, adjusting, muzzle attachment, blank.
Screw, adjusting, muzzle attachment, blank.
Spanner, muzzle attachment, blank.

The barrel is specially choked at the breech, and is marked "D.P.B." on the trunnion block. It replaces the ordinary service barrel when the gun is required for firing blank.

The muzzle cup assembles to the "D.P.B." barrel in the usual manner.

The adjusting screwed into the front cone from the rear, so that its large end may engage in the muzzle cup.

The front cone with adjusting screw assembles into the outer casing of the muzzle attachment in place of the existing front cone.

The spanner is suitably arranged for the muzzle cup, adjusting screw, and nut.

Adjustment of gun when assembled with the special parts.- The weight required to withdraw the recoiling parts of the gun to the rear when tested by pull of spring balance applied to boss of crank handle should not exceed 2 lbs. (fusee spring removed).

The weight of fusee spring when tested by pull on crank handle should be about 4½ lbs.

The adjusting screw of the muzzle attachment should first be screwed inward to the muzzle cup until it just commences to force the recoiling portions backward; it should then be unscrewed two and a half turns and secured in position by the nut. The screw may require further adjustment in order to obtain correct functioning but in no case should the screw be less than one turn back from the muzzle cup. Adjustment should be made in quarter turns.

A 250-rounds belt, preferably part-worn as regards size of pockets, should be employed. The blank ammunition should be inserted by hand crimped end flush with front edge of belt-in groups of 10 rounds. This number is sufficient for the purpose of locating M.G. fire and also ensures a longer life of choke in barrel, which in time becomes enlarged owing to the action of the hot powder gases.

The barrel casing will be filled with water as for ball ammunition.

Normally, all serviceable guns will be equipped for ball firing. Consequently, the special details for blank firing will only be fitted when actually needed.

When the gun is fitted with the blank firing attachment, it cannot be placed in its chest unless the outer casing of the muzzle attachment with its fittings is first removed.

On completion of blank firing, the guns will be immediately restored to their normal condition.

CARE OF MACI

1. Not more tl
into the barrel casin
it from freezing qu
gun has to be expos
water plus 2½ pints
A drawback, howev
that if fire is sustair
are given off. If th
these fumes have m
given off by cordite

2. Working pa
oiled rag. If firin
frictional parts.

3. Guns should
etc., and kept near
the body till requir
the recoiling portion
shots fired and the l
being kept in a clea

4. A proportio
kept warm and chan

5. If po

the gun bei
far enough to work t
this, pull the crank h
to a vertical position
the belt if necessary
lever and fire the g
barrel recoils correct

7. If a gun is ex
and other springs b
Fuzee springs shoul
increase their weight.

IGURE 4.—Reinforced Concrete Machi

T. 1432 A.
40W.O./7151

FOR OFFICIAL USE ONLY.

This Document is the property of H.B.M. Government, and the information in it is not to be communicated, either directly or indirectly, to the Press or any person not holding an official position in His Majesty's Service.

TACTICAL EMPLOYMENT OF MACHINE GUNS.

This publication cancels S.S. 192: "Employment of Machine Guns," Part I.: Tactical, of January, 1918.

1919.

uments.

FIGURE 4.—Reinforced Concrete Machine Gun Emplacement.
(For Two Guns.)

THE EMPLOYMENT OF MACHINE GUNS.

CONTENTS.

CHAPTER I.

CHARACTERISTICS AND ORGANIZATION OF MACHINE GUNS.

Section 1: *Characteristics.*
General characteristics.
Comparison with the field gun.
Comparison with the Lewis gun.

Section 2: *Organization.*
A machine gun battalion.
Army troops machine gun battalions.
Motor machine gun brigades.
Cavalry machine gun squadrons.

CHAPTER II.

GENERAL CONSIDERATIONS GOVERNING THE EMPLOYMENT OF MACHINE GUNS.

Section 3: *Surprise.*
Section 4: *Cover.*
Section 5: *Enfilade fire.*
Section 6: *Harassing fire.*
Section 7: *Anti-aircraft fire.*
Section 8: *Ammunition supply.*
Section 9: *Reconnaissance.*
Section 10: *Tactical control.*
Section 11: *Disposition in depth.*
Section 12: *Communications.*
Section 13: *Transport.*
Section 14: *Co-operation.*
Section 15: *Distribution and command.*

CHAPTER III.

MACHINE GUNS IN THE ATTACK.

Section 16: *General principles of employment.*
1. Duties in the attack.
2. Distribution.
3. Co-operation with infantry.
4. Mutual support and exercise of initiative.
5. Transport.

Section 17: *Reconnaissance, previous to plan of attack.*

Section 18: *Plan of attack.*
1. Distribution of guns and allotment of tasks.
2. Other points for inclusion in plan of attack.
3. Plans of subordinate commanders.

(807) Wt. W10092/P.P.2844. 2500. D.St.

CONTENTS—*continued.*

Section 19 : *Execution of the attack.*
1. Positions and action of guns when the attack is launched.
2. Advance of the guns.
3. Liaison.
4. Communication, information and position of headquarters.
5. Consolidation.
6. Ammunition supply.

Section 20 : *Duties of machine guns with an advanced guard.*

CHAPTER IV.
MACHINE GUNS IN THE DEFENCE.

Section 21 : *General Principles of Employment.*
1. Duties in the defence.
2. The offensive spirit.
3. Depth in defence.
4. General distribution.
5. Disposition of guns.
6. The rear system.
7. Laying out new defences.
8. Communications.
9. Ammunition supply.

Section 22 : *Siting of machine guns in defence.*
1. General principles.
2. Direct and indirect fire.
3. Control.
4. Selection of machine gun positions on the ground.
5. Summary.

Section 23 : *Tactical handling.*
1. General considerations.
2. Action in the event of a penetration of the defensive system.
3. Action of reserves.

Section 24 : *Duties of machine guns with a rear guard.*

Section 25 : *Machine gun emplacements.*
1. General remarks.
2. Reinforced concrete emplacement.
3. Champagne emplacement.
4. Moir pill box.
5. Open emplacements.

CHAPTER V.
THE EMPLOYMENT OF SPECIAL UNATTACHED MACHINE GUN UNITS.

CHAPTER VI.
MACHINE GUNS WITH CAVALRY.

NOTE :—Throughout this publication, the term "Machine Gun" refers solely to the "Vickers Machine Gun ·303"."

FIGURE 4.—Reinforced Concrete Machine Gun Emplacement. (For Two Guns.)

CHAPTER I.

CHARACTERISTICS AND ORGANIZATION OF MACHINE GUNS.

SECTION 1: CHARACTERISTICS.

In the co-operation of the various arms on the battlefield, the machine gun must be regarded as a distinctive weapon with tactics of its own, which are neither those of the infantry nor of the artillery, but intermediate between the two.

Its value in attack is as great as in defence, and in every operation the offensive possibilities of the machine gun must be developed to the full.

1 **General Characteristics.**

(1) The machine gun possesses the power of delivering a concentrated volume of fire which, owing to the ease of control, can be rapidly directed against any desired object.

As it is a piece of mechanism, the machine gun is liable to accidental cessation of fire, but in skilled hands and by the provision of spare parts and the use of ammunition which is suitably packed, its automatic action is rendered highly reliable.

Its chief characteristics are:—

(i.) *A fixed tripod mounting* and an all-round traverse.* This gives the following results:—

(*a*) The accuracy of fire is ensured by the reduction of the personal factor. Fire over the heads of friendly troops may be carried out with complete safety. Effective fire is possible at long ranges. Direction and elevation can be put on and maintained both by day and night, and indirect fire can be employed. The gun can be quickly turned in any direction that may be required.

(*b*) The fire is closely grouped so that its cone forms a regular beaten zone which is very long in proportion to its width. At close and medium ranges the fire of the machine gun is most effective, therefore, when delivered in enfilade. When close grouping is not desired, fire can be distributed by traversing, but distribution must be limited to about 50 yards of front per gun, if troops advancing in dense formation are to be effectively engaged.

(ii) *Strong mechanism, belt feed, and water cooling system.* This renders the machine gun capable of sustained fire. Provided that arrangements are made for the renewal of the barrel, the supply of oil and water and the maintenance of the supply of ammunition, the fire of the machine gun can, for all practical purposes, be maintained indefinitely, and it has been proved by experiment that the machine gun is capable in an hour of 13,000 rounds of continuous fire.

(iii) *Smallness of bulk.* This facilitates concealment. The gun and the two gunners who are required to work it, occupy small space and can, therefore, be easily hidden from view.

* A light auxiliary mounting is provided for use in emergency when the Mark IV tripod has been damaged or lost. This auxiliary mounting is not a substitute for the Mark IV tripod, and does not afford a fixed mounting for the gun. Its use is, therefore, limited to close range direct fire; it cannot be used for overhead or indirect fire.

The location of the gun may be detected by any of the following:—

(*a*) *Steam.* After about 600 rounds of continuous fire, the water in the barrel casing boils. The condenser, therefore, must be fitted carefully and in time.

(*b*) *Flash.* The flash of the gun is discernible at night, in very dull weather and against a dark background. This can be overcome by special devices.

(*c*) *Muzzle blast.* The discharge of the bullets and gases from the muzzle creates a blast which may raise a considerable dust when the gun is fired from a low mounting which brings the muzzle of the gun close to sandy or dusty ground. This can be prevented either by wetting the ground beneath the muzzle or by laying down wet sand bags. The blast will also produce a fanshaped mark which is clearly visible from the air and requires concealment by artificial means.

(*d*) *Noise of firing.* The sound of a machine gun in action is unmistakable, but as the explosion at the gun is largely offset by the crack of the bullets in the air, the position of the gun cannot readily be detected.

(iv) *Comparative mobility.* The mobility of the gun depends on its method of transport :—

When carried in the limber, the mobility of the machine gun on roads, tracks, or open ground is greater than that of the infantry.

When carried on pack animals, its mobility depends on that of the gunner, and is equal to that of the infantry. When carried by the gunners, its mobility is considerably less than that of the infantry on account of the weight of the gun, ammunition and equipment.

2. Comparison with the Field Gun.

The only point in common between the machine gun and the field gun is that both weapons are fired from a steady mounting.

The range of the field gun is considerably greater than that of the machine gun, which can only provide effective fire up to 2,900 yards. Observation of fire is considerably easier for the field gunner than for the machine gunner. The trajectory of the machine gun bullet is comparatively flat, and precise calculations, therefore, as to safety clearance have to be made by the machine gunner.

3. Comparison with the Lewis Gun.

The machine gun with its necessary accessories is over three times as heavy as a Lewis gun and is therefore less mobile.

The Lewis gun is cooled by air, and is liable to become overheated after 800 rounds of continuous fire. It is, therefore, less capable of sustained fire than the machine gun, and should be employed on targets for which short bursts of fire are suitable.

The machine gun has a stronger mechanism and is less liable to stoppages than the Lewis gun. As it is fired from a fixed mounting, the machine gun is more accurate, and can carry out overhead and indirect fire.

The Lewis gun is less conspicuous than the machine gun and can be brought into action with greater speed.

FIGURE 4.—Reinforced Concrete Machine Gun Emplacement. (For Two Guns.)

SECTION 2 : ORGANIZATION.

1. A machine gun battalion is allotted to each division and consists of headquarters and 4 machine gun companies.

A machine gun company consists of 16 guns, and is divided into headquarters and 4 sections.

Each section consists of 2 sub-sections, each of 2 guns.

2. The smallest complete tactical unit in a divisional machine gun battalion is the section of 4 guns, and the employment of machine guns in units smaller than a section should be avoided, whenever possible.

3. The machine gun battalion transport is organized so that each section is self-contained in three G.S. limbered wagons, two of which carry two machine guns each, and are known as the "gun limbers," while the third forms the ammunition limber.

In addition, a certain amount of transport is provided for battalion and company headquarters.

4. In addition to divisional machine gun battalions, there are Army Troops Machine Gun Battalions (Horse transport) and Army Troops Machine Gun Battalions (Motor transport). The former are organized upon the same lines as divisional battalions ; the latter are differently organized. The details of their organization are given in War Establishments.

There are machine gun squadrons (of which 3 are allotted to each cavalry division), each squadron consisting of headquarters and 6 sub-sections of 2 guns each.

A Motor Machine Gun Brigade consists of brigade headquarters, and 4 batteries of 8 guns each, carried on motor cycle side car combination machines.

5. Further details with regard to the organization of all the above machine gun units will be found in War Establishments.

CHAPTER II.

GENERAL CONSIDERATIONS GOVERNING THE EMPLOYMENT OF MACHINE GUNS.

These considerations must be based on the characteristics given in Chapter I; they will apply to all forms of warfare, whether offensive or defensive, mobile or stationary.

SECTION 3: SURPRISE.

The material and moral results obtained by machine gun fire opened unexpectedly on suitable targets cannot be over-estimated, and every opportunity for securing surprise effect must be sought.

SECTION 4: COVER.

Sustained fire and surprise effect are both dependent upon the skilful use of ground and cover while the gun is being brought up to its position and when it is in action.

SECTION 5: ENFILADE FIRE.

At close and medium ranges, enfilade fire gives the best results with the minimum expenditure of ammunition. Normally, frontal fire at these ranges should not be used unless an exceptional target presents itself, *e.g.*, troops in mass.

The use of enfilade and oblique fire facilitates concealment, if gun positions can be selected which are defiladed from the front.

SECTION 6: HARASSING FIRE.

The objects of harassing fire are to lower the enemy's moral, to prevent overland movement, and to dislocate his communications in rear. Harassing fire will generally be carried out by night. It forms an important feature of operations at all times.

Before the initiation of an attack, the plan for carrying out harassing fire must be considered in conjunction with the artillery and trench mortar arrangements. After consolidation, harassing fire should be conducted with vigour in order to hinder the enemy in his new dispositions. For the same reason, harassing fire must not be neglected after an unsuccessful defensive action.

To be effective, careful preliminary arrangements must be made, in co-operation with the intelligence branch, in order that the fire may be brought to bear on suitable areas. The general plan must be kept thoroughly up-to-date in accordance with the information obtained.

During a period of stationary warfare, the execution of harassing fire must never be allowed to become a mechanical and perfunctory performance. It is possible, even when the general situation is quiet, to maintain the offensive spirit. To secure a proper division of work, the machine gun harassing fire should form part of the general scheme embracing the operations of the artillery, machine guns and trench mortars.

FIGURE 4.—Reinforced Concrete Machine Gun Emplacement. (For Two Guns.)

SECTION 7: ANTI-AIRCRAFT FIRE.

By reason of its design, the machine gun is not suited for organized aerial defence work, for which the Lewis gun is to be preferred. This does not absolve machine gun units from providing their own local protection against low flying aircraft.

The importance of this type of fire results from the fact that low flying aeroplanes cannot be combated either by our own aeroplanes or by anti-aircraft guns.

As a general principle, machine guns which are not engaging ground targets, nor likely to engage them at the moment, should immediately open fire at hostile aircraft, provided that they are within range.

No aeroplane flying at a height of over 3,000 feet should be engaged, and at night only aeroplanes should be engaged which have been proved beyond doubt by the actual dropping of bombs to be the enemy's aircraft.

A good look out must be maintained at the guns, as only fleeting opportunities for engaging aircraft will occur.

Unless situated in a very conspicuous earthwork or natural feature easily discernible from the air, the risk of machine guns being located by a low flying aeroplane is comparatively small. The crack of the bullet is misleading, and attention is not directed by it to the gun position. In addition to material damage inflicted, the moral effect of the fire is very great, and observation by the occupant of the aeroplane is rendered more difficult and more likely to be superficial.

In cases where there is reason to suppose that the position of the gun or guns might be disclosed (*e.g.*, a group of 8 guns in open country), the machine gun officer on the spot must decide whether or not it is advisable to open fire.

SECTION 8: AMMUNITION SUPPLY.

*Table of ammunition: *Machine Gun Corps: Infantry.*

Where carried.	Per Gun.	Per Sect.	Per Coy.	Per Battn.
Gun limbers (two)	4,500	18,000	72,000	288,000
No. 3 limber	3,500	14,000	56,000	224,000
Total with unit	8,000	32,000	128,000	512,000
D.A.C., Echelon B... ...	4,500	18,000	72,000	288,000
Total	12,500	50,000	200,000	800,000

* This table is based on the present (1918) system of packing S.A.A. With the introduction of stripless belts in special boxes, some modification may have to be made.

The supply of ammunition is a matter of vital importance and demands the most careful organization.

The conditions under which the supply will have to be carried out in an offensive operation are so different from those in a defensive battle, that the subject is dealt with in detail in Chapters III and IV.

The greatest possible use must always be made either of wheeled or of pack transport in order to save fatigue of personnel due to carrying.

SECTION 9 : RECONNAISSANCE.

A high standard of training in reconnaissance is necessary for machine gunners.

Scouts must be trained in all their duties as laid down in Infantry Training, Sections 110 and 123 (paragraph 4). They must be capable of selecting quickly the most suitable form of cover available for the task in hand.

An accurate knowledge of the enemy's method of defence is desirable; this must be supplemented by an exact appreciation of the ground, for which all available sources of information must be employed and combined with personal reconnaissance. Where available, aerial photographs form a valuable aid, but none of these aids can eliminate the necessity for an actual visit to the ground where this is possible.

In the actual reconnaissance for gun positions, attention should be paid to the following points :—

(i.) The field of fire must be adequate for the methods of fire to be employed, and for effective co-operation with adjacent machine guns.

(ii.) Cover, especially from view, should be found for the position and its approaches, and for the gun detachment. (Chapter IV., Section 22, paragraph 4.)

Fire effect, however, must never be sacrificed for the sake of cover.

(iii.) The gun position should be sited as low as is compatible with a sufficient field of fire. This is important for success in concealment.

(iv.) Positions must be provided for observation and control.

Observation of fire and of the movement of hostile and friendly troops should be obtained from positions under cover, and, preferably within sight of the gun position. Control of fire should be direct, if possible.

(v.) The route of approach should be under cover : for this, a detour may have to be made. Ease of communication and supply will largely depend on the nature of the route selected. The fact that communications to alternative positions may be required must also be borne in mind.

(vi.) Positions for transport must be found. Limbers or pack transport should be brought as close to the gun position as cover will allow, although, if the situation so demands, cover may have to be sacrificed to speed of action.

(vii.) The question as to whether an escort will be required must be considered.

(viii.) When hostile fire compels a change of position, the guns should be moved to an alternative position. This should be selected as soon as the orginal position has been chosen. There should be a covered approach, and, as nearly as possible, a similar field of fire to that of the original position.

(ix.) Lines of advance or retirement to the next position must be selected.

SECTION 10 : TACTICAL CONTROL.

Tactical units must be kept intact. The maximum fire effect is obtained by the employment of collective fire from a number of guns operating under one control. The number of tactical units employed must be sufficient for the task in hand.

The use of individual machine guns, operating alone, results in loss of control, difficulty of supply, and dissipation of fire power.

FIGURE 4.—Reinforced Concrete Machine Gun Emplacement. (For Two Guns.)

SECTION 11 : DISPOSITION IN DEPTH.

Disposition in depth is essential, and must be a guiding principle in machine gun tactics. It enables flexibility of control to be maintained, and affords protection to flanks.

SECTION 12 : COMMUNICATIONS.

In addition to the machine gun battalion signallers, a machine gun battalion will usually have the services of the machine gun section of a divisional signal company.

This section is an integral part of the divisional signal company, and as such, it is available for work in the general signal system of the division. Its employment as regards the machine gun battalion is analagous to that of a brigade signal section with the brigade, and its primary duties are to connect the groups into which the machine gun battalion is divided, and to link them up with the divisional system.

No attempt must be made to establish a separate signal system for machine gun communication within the division other than that indicated above. It follows that the greatest possible use of the divisional system must be made by connections to existing exchanges.

The work of the signal section will be assisted by the machine gun battalion signallers.

Wherever possible, telephonic communication should be supplemented by visual signalling; despatch riders and runners should be employed to the full extent, especially in offensive operations where telephonic communication will be limited.

SECTION 13 : TRANSPORT.

Although technically a dismounted unit, the employment of the transport in a machine gun battalion is entirely different from that in an infantry battalion. The transport is essentially a fighting portion of the battalion. Without its transport, the machine gun section is immobile; the three vehicles of the section must be regarded as an integral part of the section, and must ordinarily be with it. (*See* Chapter III., Section 19, paragraph 6.)

The training of machine gun sections with their transport must be practised on all possible occasions; this applies especially to periods of stationary warfare, when the section transport lines may be at a considerable distance from the section headquarters. In such cases training is sometimes apt to be overlooked.

Gun limbers must be used boldly, and the drivers must be trained to make skilful use of ground and cover.

SECTION 14 : CO-OPERATION

Co-operation is the foundation upon which successful machine gun tactics rest. To ensure it, the closest possible liaison must be maintained between machine gun units themselves, and between machine gun units and other arms.

The intentions of a commander for any operation should be communicated to the senior machine gun officer in the form of general instructions. After consultation with the commanders of the other arms employed, this officer will submit a detailed plan for the employment of machine guns, and when this has been approved, he will be responsible for issuing the necessary orders to the machine gun units. It is important that latitude should be allowed to the machine gun officer in deciding upon the dispositions and methods of fire by which the general instructions can best be carried out, as the application of

machine gun fire differs in many important respects from that of rifles or Lewis guns. Similarly, orders given by the machine gun officer to his subordinates operating in forward areas should generally be given as tasks, in order that initiative may not be fettered when dealing with local conditions and unforeseen developments.

Unity of control is essential if full use is to be made of available resources; within reasonable limits, the larger the number of machine guns which can be placed under one directing authority, the less will be the overlapping of functions and consequent waste of fire power.

The object of the employment of machine guns is to support by fire the action of other troops. This support can only be ensured if the machine gun officer possesses a knowledge of the tactics of other arms, and seeks mutual understanding by means of personal liaison on all occasions. Similarly, the best results can only be obtained if the commanders of other arms, especially the infantry, possess a general knowledge of machine gun tactics and the scope of machine gun fire.

As machine gun units when on the march are comparatively defenceless, and even when in action possess limited means of self-defence, occasions will arise when an escort is required for them. The escort should be provided by the troops with whom they are operating.

SECTION 15 : DISTRIBUTION AND COMMAND.

1. The machine gun battalion is, and must be employed as, a tactical unit, and the machine gun battalion commander is a tactical commmander. The executive arrangements for the divisional commander's plan of machine gun action are in the hands of the machine gun battalion commander, whose position and duties are analogous to those of the C.R.A. of a division. He must ensure that the system of command and the rôles allotted to machine gun units are understood by the machine gun officers, and by the infantry brigade and battalion commanders in whose areas the machine gun units may be operating.

In all preparations, whether for attack or defence, the machine gun battalion commander brings his influence to bear in the disposition or allotment of the machine guns over the whole divisional front. Once battle is joined, his power is exercised mainly through the handling of the machine gun reserves which are at the disposal of the divisional commander, but he should assist group commanders in carrying out orders received from or through the respective brigade commanders.

It is only in this way that the fullest value can be obtained from the machine gun resources of a division.

2. Rigidity in the allotment of machine guns must be avoided. It will not generally be necessary or desirable to make permanent attachments of machine gun units to infantry brigades or battalions, but portions of the divisional machine gun battalion should be distributed and redistributed in accordance with tactical considerations on the divisional front as a whole.

3. In order that the requirements of the division as a whole may be considered, the machine gun battalion should be organized in groups, to be employed as brigade and reserve groups. The number and composition of these groups will be determined by the divisional commander, and, during active operations, it may be necessary to increase or to decrease the groups according to tactical requirements. No alteration, however, can take place in the original allotment of machine gun units to an advanced or rear guard or other detached force with a special mission, so long as it continues to operate as such. (*See* Chapter III., Section 20, para. 1, and Chapter IV., Section 24.)

FIGURE 4.—Reinforced Concrete Machine Gun Emplacement. (For Two Guns.)

A brigade group must be detailed in the divisional commander's orders to co-operate with the infantry brigade which it is to support and must act in the closest liaison with that brigade. The group will be commanded by an officer detailed by the machine gun battalion commander.

The reserve group or groups will be under the direct command of the machine gun battalion commander, acting under the orders of the divisional commander.

4. Machine gun units which are detailed to co-operate with infantry brigades for offensive operations, or which are located in brigade sectors in the defence, will be under the tactical control of the infantry brigade commander concerned.

In this connection it must be realized by all commanders that machine gun units temporarily allotted for a specific tactical purpose are likely to be withdrawn on the completion of their tasks.

5. In addition to the disposition and allotment of the guns under the divisional scheme, control by the division will include arrangements regarding reliefs and reinforcements of personnel and material.

6. In order that the divisional plan of machine gun action may be adhered to, infantry commanders must not alter the disposition or tasks of machine gun units. unless a new and unforeseen tactical situation has arisen which is not covered by the original rôles allotted to the machine guns in the divisional plan. Should such a new and unforeseen situation arise, however, it is the duty of infantry commanders to issue fresh orders to the commander of the machine gun units co-operating with them, at the same time informing superior authority of the action taken. In such cases, the machine gun units affected will revert to control by superior authority as soon as the latter has issued orders to deal with the new situation

7. The normal duties of the divisional machine gun battalion commander, therefore, may be summarized as follows:—

(*a*) To command, to administer and to train the machine gun battalion.

(*b*) To direct the tactical action of the machine gun companies under his command, in accordance with the orders of the divisional commander, and in close co-operation with the other arms.

(*c*) To prepare, for the approval of the divisional commander, the plan of operations for the machine gun units of the division, both in offence and defence, and to co-ordinate these plans with those of the divisions on either flank.

(*d*) To arrange reliefs of machine gun companies, and the maintenance of their personnel and material in the line.

(*e*) To be responsible for keeping infantry brigades in the line informed as to the dispositions of the machine gun units covering their respective sectors, and to ensure that close and constant liaison is maintained between infantry and machine gun units.

(*f*) To supervise the siting and construction of machine gun emplacements in the divisional area.

CHAPTER III.

MACHINE GUNS IN THE ATTACK.

SECTION 16 : GENERAL PRINCIPLES OF EMPLOYMENT.

The main principles of attack are laid down in Field Service Regulations Part I.

The application of these principles to the present conditions of warfare is laid down in S.S.135, "The Division in Attack," which must be studied in conjunction with this manual.

1. *Duties in the attack.*—The energetic and determined support of the infantry by fire is the main duty of machine gun units throughout the whole course of the battle.

The fire of machine guns may be either direct or indirect. Primarily the machine gun is a weapon for direct fire, but indirect fire may be usefully employed to search localities on which direct fire cannot be brought to bear, and to harass the enemy's back areas and communications. Indirect fire also permits of distribution in depth without undue sacrifice of fire power. When a target cannot be engaged by direct fire, the machine gun officer must immediately endeavour to engage it by indirect methods.

In the attack the first duty of machine gun units is to assist the advance of the infantry. They must carry out this task by providing covering fire, both direct and indirect, by dealing rapidly with any hostile targets which may present themselves during the course of the battle, and by producing the greatest fire effect at points where the progress of the infantry is checked.

Their other duties are to protect the flanks of the infantry against counter-attacks during the advance, to form pivots upon which the infantry can rally if it is driven back, and to act as a reserve of fire power in the hands of commanders for offensive or defensive purposes as the situation may demand. It follows from the above, that the disposition of guns in depth must be maintained throughout.

2. *Distribution.*—The machine gun battalion commander must be present when the general plan of attack is being discussed by the divisional commander with the brigade commanders; he will then submit proposals, through and in consultation with the general staff, for the distribution and employment of the machine guns, which, if approved, will be incorporated in the divisional commander's orders.

It is the duty of the machine gun battalion commander to issue orders to his battalion for the execution of the divisional commander's orders; in this he must be guided by a close study of the general plan of attack, the dispositions of the enemy, and the character and condition of the ground.

Unless there is a general, pre-arranged and comprehensive plan for the action of machine guns, machine gun units will not be able to render that continuous support during the attack which is necessary if fire superiority is to be gained, and if the demoralization of the enemy is to be effected at each successive stage of the advance.

3. *Co-operation with Infantry.*—It is essential that there should be the closest co-operation between the machine gun units and the infantry.

FIGURE 4.—Reinforced Concrete Machine Gun Emplacement. (For Two Guns.)

All machine gun commanders must know the plan of action of the infantry which they are to support; similarly, infantry commanders must be fully aware of the intentions and dispositions of the machine gun units supporting them.

During the battle it becomes more than ever important that infantry and machine gun commanders should keep one another informed as to the progress of the fight and the action which is being taken.

4. *Mutual support and exercise of initiative.*—The principle of mutual support must always be borne in mind. Thus a machine gun unit which has been detailed for the direct support of a particular infantry unit must always be prepared to cover the advance of a neighbouring infantry unit, if the opportunity should arise.

Where the character of the country over which the attack is to be made particularly lends itself to mutual support, definite arrangements can be made in advance, but such support will be found more often to depend upon the exercise of initiative by the machine gun commander on the spot.

The general plan of machine gun action framed by the machine gun battalion commander should be adhered to. It is, however, of great importance that this plan should be so framed as to allow considerable latitude to machine gun groups in regard to the manner in which they may carry out their tasks. This is particularly the case as regards machine gun sections working in close support of leading infantry battalions, where the initiative of the section commander, acting in close co-operation with the infantry battalion commander, should be allowed full scope.

5. *Transport.*—The fullest use must be made of all transport in an offensive operation. Resort must only be made to man-handling when all other means of transport have been found impossible.

If a route can be reconnoitred, or selected after a careful study of maps and aeroplane photographs, and if sufficient latitude can be allowed as to the line of advance, wheeled transport is usually able to reach its destination.

If the ground is likely to prove difficult for transport it may be advisable to employ half-limbers either (*a*) with a full team, or (*b*) with the leaders carrying guns and tripod on pack saddle. Half-limbers can be taken over almost any ground which is passable for pack animals.

When crossing exposed ground, wheeled transport should gallop for the next cover, and the gun detachments should work their way to it independently.

When in action, the limber can be left under cover close to the gun, while the animals are taken back to a safe distance. The limber will then serve as the ammunition dump, and, if a change of position is ordered, can be loaded ready to move off as soon as the animals are brought up.

The employment of pack transport throws a considerable strain on men and animals, both as regards casualties and fatigue. Pack animals are difficult to manage under fire, and are often stopped by wire and trenches. If more than 16 animals in a machine gun company are employed for pack, a proportion of the limbered wagons is rendered immobile. Pack transport therefore, should not be used unless it is impossible for wheeled transport to reach its destination.

SECTION 17 : RECONNAISSANCE, ETC., PREVIOUS TO PLAN OF ATTACK.

1. Before forming his plan of attack, the machine gun battalion commander must be acquainted with the intentions of the divisional commander, and the general scheme of attack. He must know :—

(*a*) The scope of the attack, the various objective lines, the boundaries between units engaged and the action of the flanking divisions; and

(*b*) The amount of artillery, trench mortars, tanks, etc., which will be available to support the infantry at the various stages of the attack.

Having obtained this information, he must study the enemy's dispositions in order to appreciate:—

(*a*) The depth of the enemy's outpost zone, the position of his main zone of resistance and the location of his reserves; and

(*b*) The amount and nature of the resistance to be expected in the enemy's outpost zone and beyond.

Finally he must make himself acquainted by a close study of maps and aeroplane photographs, and by personal reconnaissance, with the ground over which the attack is to take place. He must take into consideration:—

(*a*) The character of the enemy's defences and obstacles which will be encountered by the infantry at the various stages of the attack, and the facilities for machine gun support;

(*b*) Whether the greatest difficulties are likely to be encountered by the right, the left, or the centre of the attack;

(*c*) Whether the flanks are liable to become dangerously exposed; and

(*d*) The assembly positions most likely to be used by the enemy for counter-attacks.

A proper distribution of guns and allotment of tasks can only be decided upon after weighing all the above considerations, and, in this connection, it is well to note that the more it is possible to lighten the tasks of machine gun units at the outset of the attack, the more vigorously will they be able to intervene in its later stages, when the artillery support may be thinner and the enemy's resistance possibly stiffening.

2. A previous study of the ground is also necessary in order to decide upon:—

(*a*) Positions from which initial covering fire can be best delivered.

(*b*) Suitable places for fire positions as the advance progresses.

(*c*) The best routes of advance and any natural obstacles likely to be encountered, both as regards personnel and transport; and

(*d*) Tactical features or other landmarks which will act as guides during the advance.

3. Subordinate machine gun commanders must similarly make a careful study of the ground, in so far as it affects the execution of the tasks with which they have been entrusted.

SECTION 18: PLAN OF ATTACK.

1. *Distribution of Guns and Allotment of Tasks.*—Orders for the general plan of machine gun action will be drawn up by the machine gun battalion commander in conformity with the divisional instructions for the attack as issued by the general staff, and will prescribe the distribution of guns and the allotment of tasks to units on the following lines:—

FIGURE 4.—Reinforced Concrete Machine Gun Emplacement. (For Two Guns.)

(*a*) The proportion of guns to be allotted to the groups detailed for the direct support of infantry brigades, and the proportion to be retained under divisional control, must be decided, and groups detailed accordingly.

(*b*) The brigade groups will be divided into two classes of guns:—

Forward Guns: whose first task is to work forward in close support of definite infantry battalions in the attack. (*See* Chapter II., Section 15, paragraph 2.)

Supporting Guns: which may be employed either to take part in the initial programme of covering fire, or to form reserves within brigade groups, or both.

(*c*) It will seldom be possible to lay down in any but the most general terms, the method in which the forward guns will carry out their task. The successful performance of a task will depend very largely upon the initiative and boldness displayed by the machine gun officers in command.

The rôle of the forward guns is to cover gaps in the attack, to deal rapidly with any targets which may present themselves (*e.g.*, bodies of the enemy's infantry, machine guns, anti-tank guns or other artillery), and to assist in the reduction of the enemy's strong points by bringing concentrated fire to bear on them.

(*d*) It may be considered advisable to detail a proportion of the forward guns for the sole purpose of consolidating the objective. Units so detailed should not be expected to perform other tasks during their advance, as it is essential that they should arrive at their positions with an adequate supply of ammunition.

(*e*) As regards the initial programme of covering fire, it must be stated whether it is to take the form of direct overhead or flanking fire, or of indirect fire, and, if both, the number of guns to be allotted to each task must be given.

Machine gun units retained under divisional control can also be employed to assist in the initial covering fire.

Where the covering fire from a large number of guns is co-ordinated under central control, so that it extends over a considerable and continuous frontage, it is known as "barrage" fire. The considerations which should govern the employment of this form of fire are set forth in Chapter III., Section 19, paragraphs 1 (*c*) and 2 (*c*).

(*f*) The subsequent rôle of the machine gun units which are used for the initial covering fire must be indicated.

They may be required:—

(i.) To provide further covering fire from more advanced positions.

(ii.) To protect flanks.

(iii.) To provide reserves.

(iv.) To pass through the leading infantry battalions working in close co-operation with other battalions detailed to exploit success.

Similarly, it may be necessary to indicate the subsequent rôle of the forward guns which have been supporting the assaulting infantry battalions in the early stages of the battle.

They may be required for consolidation or for any of the purposes to which reference is made in (i.), (ii.) and (iii.) above.

Pamphlet-makers and instruments.

The general arrangement at every stage of the attack must be such that:—

(i.) Commanders may have sufficient guns in reserve with which to obtain superiority of fire in the event of any serious resistance being encountered.

(ii.) Rapid intervention to a flank may be possible.

(iii.) Adequate distribution in depth may be maintained as a defence against possible counter-attacks.

(*g*) The rôle of the guns retained under direct divisional control must be explained. In addition to their use as reserves with which to influence the fight, these guns may be used to increase the size of brigade groups, or to relieve tired machine gun units belonging to these groups.

(*h*) Any special measures which are to be taken for mutual support should be stated, including any arrangements which have been made in this connection with the divisions on either flank.

2. *Other points for inclusion in plan of attack.*—The general machine gun plan will also deal with the following points:—

(*a*) A general indication of routes of advance, both for personnel and transport.

(*b*) Arrangements for liaison and positions of headquarters.

(*c*) Methods of communication.

(*d*) Arrangements for the supply of ammunition, rations and water.

(*e*) Instructions for consolidation.

(*f*) Medical arrangements.

3. *Plans of subordinate commanders.*—The plan of attack of a brigade machine gun group commander must be based on the orders he receives from his machine gun battalion commander, and the requirements of the infantry brigade commander.

Similarly, if machine gun sections are detailed by a brigade group commander to support definite infantry battalions, the action of the section commanders must be based on the orders they receive from their group commander and the requirements of the infantry battalion commanders.

In the case of a machine gun unit forming part of a detached force, where no machine gun group organization exists, the machine gun commander will receive orders direct from the commander of that force.

SECTION 19: EXECUTION OF THE ATTACK.

1. *Positions and action of guns when the attack is launched.*—

(*a*) The forward guns should be formed up in assembly positions which must be chosen with reference to:—

(i.) The forming up place of the infantry units which they are supporting.

(ii.) The proposed route of advance.

(iii.) The probable line on which the enemy's barrage will first descend.

It will usually happen that these positions have to be taken up during the night before the attack. In order to avoid confusion, previous reconnaissance of these positions by night is desirable, if time permits.

FIGURE 4.—Reinforced Concrete Machine Gun Emplacement.
(For Two Guns.)

It is the duty of the general staff to see that the movement of machine gun units to their assembly positions is properly co-ordinated with that of the other arms.

(*b*) The guns employed to carry out the initial programme of covering fire should, as far as possible, be sited in inconspicuous positions in the areas of lesser shelling and in places which are usually unoccupied by troops.

When time permits, emplacements should be dug beforehand, and stocked with water and S.A.A., and, if required, a belt filling shelter should be erected in the vicinity.

Work should be done at night and concealed by camouflage by day.

When the depth of the advance permits, the positions for the guns used to supply covering fire should be chosen with a view to the avoidance of a move during the operation (but see paragraph 2 (*c*)).

Machine gun units detailed for employment in the initial programme of covering fire may have to occupy their allotted positions one or more days before the attack. In such cases, every precaution for concealment must be taken.

(*c*) Covering fire may sometimes take the form of barrage fire.

A machine gun barrage may be standing or creeping. In either case it should be co-ordinated with the artillery barrage.

When a creeping barrage is employed, the machine gun lifts should be not less than 200 yards.

In order to allow a sufficient safety margin, it will seldom be possible to put down a frontal machine gun barrage less than 400 yards ahead of the leading troops.

When there are definite pauses in the advance, guns employed on barrage work can be utilized for the purpose of putting down a protective barrage in response to an S.O.S. call. This will only be possible, however, where the leading infantry is not more than 2,000 yards in front of the guns.

The following conditions must not be overlooked if barrage fire is to be effective:—

(i.) To obtain a sufficient density of fire, there should be not less than 1 machine gun to 50 yards of the frontage engaged.

(ii.) Central control and good communications are necessary.

(iii.) Close grouping of guns may be required.

(iv.) Control by time table will generally be necessary, as direct observation will seldom be possible owing to the smoke and dust of the artillery barrage, mist, or darkness.

2. *Advance of the guns.*

(*a*) *General Rules.* (i.) When advancing, all machine gun units, whatever their immediate rôles may be, should move forward by "bounds" from one position to another along pre-arranged routes. These positions should be reconnoitred by section commanders during the advance.

(ii.) Gun positions should be selected primarily with a view to the employment of direct overhead covering fire where the ground permits, and facilities for flanking or enfilade fire should also be taken into account. Concealment must be sought, not only from direct ground observation, but also from the air, and conspicuous points liable to shelling by the enemy's artillery should be avoided.

Range-takers and Instruments.

(iii.) During the initial stages of an attack, the forward movement of machine gun units can generally be fixed according to a time table, but, as the advance progresses, it will be necessary to give subordinate commanders a freer hand.

(iv.) Every use must be made of limbers (or failing them pack transport) to get the guns forward quickly and to prevent the premature exhaustion of machine gun detachments. It will generally be inadvisable to take limbers or pack transport right up to machine gun positions for fear of disclosing the positions.

(*b*) *Special rules governing the advance and action of forward guns.*

(i.) The advance of the machine gun units comprising the forward guns must be characterized by an aggressive determination to assist the advance of the infantry by every means in their power. Their line of advance should be the line which will take them with the least delay to the points from which they can most effectively engage the enemy. Machine gun commanders should move forward in advance of their units, and reconnoitre the ground, in order to appreciate the tactical situation, and to have their guns in position in time to intervene in the fight at points where their assistance is required.

(ii.) Opportunities for effective intervention by machine gun units in support of the troops operating on the flanks of their line of advance will often occur. Where such action is possible without prejudice to the infantry which they have been detailed especially to support, machine gun units should take up positions from which assistance can also be lent to infantry operating in neighbouring sectors.

(iii.) Machine gun units are not suited to take part in the close struggle for progress, and mere gain of ground should not be attempted if it entails the sacrifice of a position already occupied which affords better facilities for carrying out the task in hand.

(iv.) Throughout their advance machine gun units should make use of all available cover to conceal their forward movements. They should always be ready, however, to move forward quickly and boldly in order to take prompt advantage of any temporary paralysis in the enemy's defence which an attack delivered by surprise and pressed with vigour is liable to occasion.

In such phases of the battle, opportunities present themselves which will be lost if they are not seized immediately.

(v.) Where hostile machine gun nests are encountered, it is not necessary to withhold machine gun fire until individual machine guns have been located. Fire must be opened in order to neutralize the areas containing such machine gun nests. As the battle develops, the opportunities for engaging individual hostile machine guns may increase.

(*c*) *Special rules governing the advance and action of supporting and reserve guns.*

(i.) Where, owing to the depth of the attack, it is necessary for machine gun units employed on the initial programme of covering fire to carry out a move in the performance of their task, this move should invariably be regulated by a time table and the approximate location of new positions must be fixed beforehand.

Positions where it is probable that the enemy will put down an artillery barrage must be studiously avoided. Camouflage material should be taken forward to assist in the concealment of the new positions.

FIGURE 4.—Reinforced Concrete Machine Gun Emplacement. (For Two Guns.)

(ii.) Once the attack has progressed beyond a certain stage, there is, as a rule, little scope for machine gun barrage fire. Barrage fire is not possible unless:—

(*a*) Large scale maps and a plentiful supply of S.A.A. are available.

(*b*) There is time to prepare positions and to work out calculations.

It will usually be found that the conditions of rapidly moving warfare are such that the advance of the infantry can best be supported by direct covering fire, which it will not be possible or desirable to organize in barrage form.

(iii.) Machine gun units employed on covering fire in the initial stages of the attack must, on the completion of their tasks, be quickly reconstituted as mobile units ready to carry out their allotted rôles in the ensuing phases of operations. It is vital therefore that machine gun units should keep those infantry units which they have been specially detailed to support constantly informed of their whereabouts and of the action they are taking in accordance with the general machine gun plan.

3. *Liaison.*—The importance of close liaison and co-operation between machine gunners and infantry has already been emphasized. This will be largely facilitated if the headquarters of machine gun commanders are situated in the vicinity of those of the infantry commanders whose units they are supporting. This should present no difficulty in the case of the machine gun battalion commander or his group commanders. (*See* paragraph 4 of this section.) Section commanders, however, must be in a position from which they can control their guns, and especial attention must be paid, therefore, to the maintenance of close liaison with the infantry battalion commanders concerned. This can only be achieved if the machine gun commander is kept regularly informed as to the position of infantry battalion headquarters and reports there personally from time to time. The infantry battalion commander should repeat all messages regarding the situation of his leading troops to the machine gun commander and the latter should repeat all messages regarding the disposition of his guns and the general situation in his vicinity to the infantry battalion commander. It is the duty of the machine gun commander to endeavour to anticipate the requirements of the infantry battalion commander as well as to comply immediately with his definite requests.

It is the essence of liaison that its maintenance is the duty of both parties concerned.

4. *Communication and information.*

(i.) The highly developed systems of telephonic communication which are possible in stationary warfare cannot be maintained in a war of movement. It will very rarely be possible to provide any communication by wire forward of infantry brigade headquarters, and it is impossible to count on the telephone forward of divisional headquarters. Commanders of forward machine gun units must, therefore, accustom themselves to rely entirely upon other methods of communication, such as visual signalling, runners, mounted orderlies, etc.

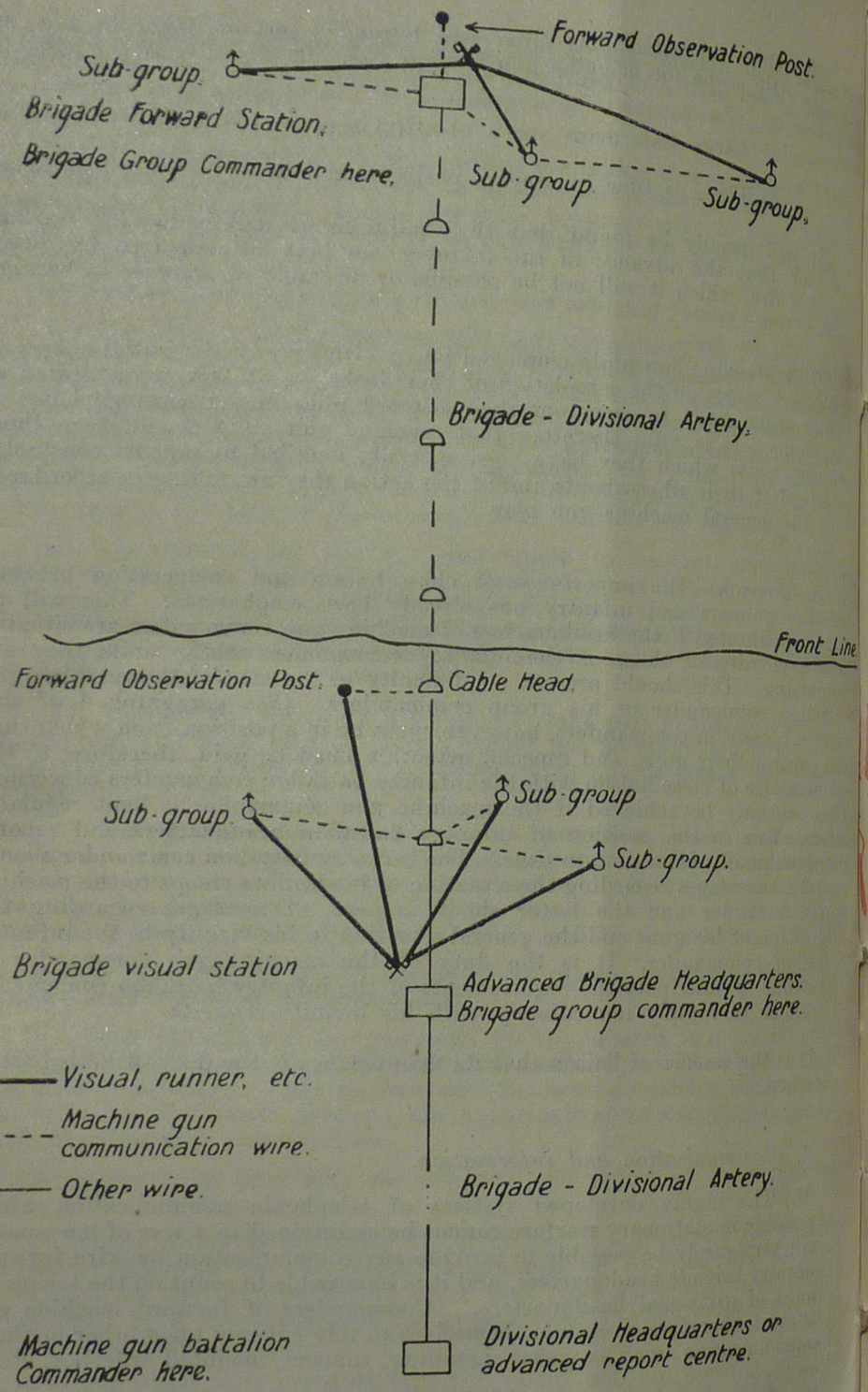


FIGURE 1.

This diagram shews a typical system of communications before and during an attack. The lower half of the diagram shews the system before the attack, and the upper half shews how the communications are continued as the advance progresses.

FIGURE 4.—Reinforced Concrete Machine Gun Emplacement. (For Two Guns.)

(ii.) As a general rule, effort will be concentrated upon the maintenance of one main artery of communication from front to rear, and consequently headquarters of machine gun battalions and groups should be placed in as close proximity as possible to this main artery, on which signal offices must be established to serve several headquarters.

(iii.) It follows that :—

(*a*) Headquarters of the machine gun battalions should be located at or near an existing signal office on the main artery between division and brigades.

(*b*) Headquarters of a brigade machine gun group should be located at or near brigade headquarters.

Beyond brigade headquarters, communications will generally have to be effected without wire, and machine gun commanders must make every effort to organize beforehand all means at their disposal.

(iv.) The essential communications to be maintained are between :—

(*a*) Machine gun battalion headquarters and brigade groups.

(*b*) Brigade groups and supporting guns.

(*c*) Machine gun battalion headquarters and reserve groups.

It will rarely be possible for the brigade group commander to exercise continuous control over the forward guns once they have been committed to the attack. (*See* paragraph 1 (*c*) of Section 18, Chapter III.)

In cases where a machine gun battalion headquarters is situated at a divisional headquarters some distance in rear, a forward report centre for the machine gun battalion may be established on the main artery between division and brigades.

(v.) The divisional signal company commander is responsible for the signal arrangements of the machine gun battalion as far as the brigade groups. This work must be carried out by the machine gun section of the divisional signal company which will be attached to the headquarters of the machine gun battalion, and will receive all technical instructions for carrying out the plan of machine gun communication from the divisional signal company commander.

(vi.) It is of the greatest importance that every subordinate machine gun commander should keep his machine gun commander and the commander of the infantry unit with whom he is co-operating constantly informed of his location, intentions, and the situation in his vicinity. The preparation, beforehand, *e.g.*, on the back of the signal message form, of sketch maps of the ground over which he will be operating, will provide a message on which his location can be conveyed quickly and accurately to those who require it.

5. *Consolidation.*—Where the attack is limited in depth, the arrangements for consolidation should be thought out beforehand in detail; the precision, however, with which instructions on this subject can be issued before the attack must in each case depend on the scope of the operation as a whole.

The following points are of general application :—

(*a*) A pause in the advance may occur either in accordance with the general plan of attack, or owing to the strength of the enemy's resistance, the exhaustion of the attacking infantry, nightfall, or any other cause. When such a pause is anticipated, machine gun commanders should at once reconnoitre the ground with a view to moving their guns, if necessary, into positions more suitable for defence in depth than those which they have occupied during the attack.

(*b*) If the attack is likely to come to a standstill at dusk, it is particularly important that final positions should be selected and occupied, and range cards prepared, before the light fails.

(*c*) Whenever, for any of the reasons mentioned in (*a*) above, there is a pause in the battle, and especially at dusk and at dawn, hostile counter-attacks are liable to develop.

At this stage, the infantry may be in unfamiliar surroundings, often exhausted by hard fighting, and perhaps somewhat disorganized. Machine gun units can do much to protect the position and to safeguard the flanks. This may necessitate the placing of machine guns as a temporary measure in isolated positions, possibly in advance of the main infantry line. In this case, the guns should be accompanied by an infantry escort. If an escort is not provided, it is the duty of the machine gun officer on the spot to apply for one, and the responsibility of the infantry commander to supply it.

(*d*) The advisability of detailing definite guns before the attack for the special purpose of consolidating some particular tactical feature depends upon :—

(i.) The importance which is attached to the retention of the feature in question ; and

(ii.) The likelihood of a counter-attack in strength.

Where no serious hostile reaction is expected, it is usually better to keep machine gun resources well in hand.

(*e*) The machine gun battalion commander must take advantage of pauses in the operations to review the machine gun situation generally, to satisfy himself that proper measures for consolidation are being adopted, and to consider the advisability of the employment of reserve guns, of carrying out reliefs, etc.

He will often find that the guns have become over-concentrated or over-dispersed in the course of the fighting, and he may have to arrange for their regrouping.

(*f*) The state of readiness for repelling a counter-attack should be supplemented during the night by a vigorous programme of harassing fire on roads and tracks, covered lines of approach, and possible places of assembly.

Where the situation is sufficiently definite, and time permits, it may be possible to organize a certain number of machine gun units in rear so that they are available to put down a protective barrage in response to an S.O.S. signal. Such units may sometimes be usefully employed to open fire at a slow rate on their S.O.S. lines, in order to cover the work of consolidation by the infantry.

6. *Ammunition Supply.*

(*a*) *General remarks.*—The supply of ammunition is a matter of vital importance and demands careful organization.

As a general principle, the supply must proceed from rear to front, that is to say, the supply should be pushed forward according to the tactical situation without waiting for demands from the firing line.

Ammunition must be sent forward in accordance with instructions issued from time to time from battalion headquarters.

The supply from battalion to group, and from group to section, must be controlled by officers of the battalion and group headquarters respectively. The supply from section headquarters to the guns must be controlled by a non-commissioned officer under the supervision of the section commander.

FIGURE 4.—Reinforced Concrete Machine Gun Emplacement. (For Two Guns.)

The machine gun battalion quartermaster is responsible for drawing and issuing ammunition in accordance with the instructions he receives from his battalion headquarters.

Ammunition is drawn from the D.A.C., and during operations it is usual for an advanced S.A.A. dump to be formed under divisional arrangements.

It is usual for the machine gun battalion to establish a rear headquarters at its transport lines, which should, if possible, be close to the divisional S.A.A. dump.

It may be necessary to establish belt filling centres at the brigade group dumps and possibly at the machine gun battalion or other headquarters according to convenience.

The principle is that as much filling as possible should be done in rear with a view to the reduction of traffic and movement near the gun positions.

(*b*) *Method of Supply.*

(i.) Before the attack is launched, dumps of ammunition for the use of guns which are to be employed in the initial covering fire should be formed at the actual gun positions.

In this connection, it must be borne in mind that barrage fire expends large quantities of ammunition.

(ii.) A certain amount of ammunition should be carried forward by the gun detachments. The amount thus carried must depend upon the distance which is to be travelled, the condition of the ground, and the physical capacity of the men.

The danger of exhausting the gun detachments unduly must always be borne in mind.

(iii.) Special carrying parties may be employed to carry forward additional supplies of ammunition.

This is laborious and expensive in men, and should not be resorted to more than is absolutely necessary. It must be remembered that when such carrying parties have to be employed, they will usually be drawn from the infantry.

The amount a man is given to carry should not, as a rule, be more than two filled belt boxes. The use, however, of tump lines or Yukon packs is of value in order to lessen physical fatigue, and thus to increase the distance over which the carrying parties can travel. It is not advisable to increase the load by means of these carrying devices, as the distance which can be travelled forms the primary consideration.

(iv.) The supply of ammunition by limber or pack transport is the normal method.

Limbers used for this purpose carry 14,000 rounds of bundle-packed S.A.A., and a pack animal carries 8 filled belt boxes (2,000 rounds) or 2,000 rounds bundle-packed S.A.A.

The usual system is for 2 limbers per company to be withdrawn into battalion reserve while the remaining limbers form a company or group reserve.

After these limbers have been emptied, they must be sent back to be filled up from the D.A.C., being replaced by full limbers from battalion reserve.

(v.) Arrangements may be made for ammunition to be carried forward in tanks, when these are available.

(vi.) In an emergency, ammunition can be dropped from aeroplanes by means of parachutes. This must not, however, be regarded as a normal method of supply.

Range-takers and instruments.

The usual procedure is for any machine gun detachment which urgently requires ammunition to put out a white " V " shaped ground signal.

A single aeroplane can carry two boxes of bundle-packed S.A.A.

SECTION 20 : DUTIES OF MACHINE GUNS WITH AN ADVANCED GUARD.

1. The duties of an advanced guard render it necessary that great fire power should be available in the shortest possible time. A large proportion of machine guns will, in consequence, usually be allotted to advanced guards, and complete tactical units should invariably be employed for this purpose. These units will come under the orders of the advanced guard commanders concerned in the same way as units of the other arms of which these forces are composed. Advanced guard commanders will accordingly be responsible for the distribution of guns between the vanguard and main guard, and for the allotment of tasks.

2. The main duties of machine gun units in an advanced guard will normally be :—

(*a*) To assist the infantry to drive in the enemy's advanced troops by rapid development of fire at the required points.

(*b*) To assist the infantry in holding any position gained.

(*c*) To cover the deployment of the main body by holding the enemy on a wide front.

(*d*) To protect an exposed flank or flanks.

3. Machine gun units should be placed well forward in the order of march in order to enable them to come quickly into action, but, if employed with a van-guard, they must be protected against surprise.

There will generally be opportunities for oblique or enfilade fire of which full advantage should be taken.

Failing the engagement of targets by direct observation, the cross-fire from two or more sections of machine guns disposed so as to sweep suspected areas will often prove of value.

Opportunities for direct fire should be sought, and this type of fire should be employed as much as possible. This does not mean that indirect fire should never be employed, but in the mobile fighting of an advanced guard indirect fire methods will usually only be advisable when the officer controlling the fire is in a position to watch the movements of the infantry, to control his guns by word of mouth or by direct visual signalling, and to observe the fire of his guns.

If an attack on any particular locality becomes necessary, the employment of frontal fire by machine guns, covering an enveloping movement by the infantry, will usually prove most efficacious.

Close co-operation with the infantry is essential.

The bold and skilful handling of the machine gun limbers will assume especial importance in the deployment and in the subsequent advance of the machine gun units by bounds, as the advanced guard presses forward.

Mounted officers and orderlies and scouts on bicycles or on foot will be found invaluable for reconnaissance and communication.

FIGURE 4.—Reinforced Concrete Machine Gun Emplacement. (For Two Guns.)

CHAPTER IV.

MACHINE GUNS IN DEFENCE.

SECTION 21 : GENERAL PRINCIPLES OF EMPLOYMENT.

The main principles of defence are laid down in Field Service Regulations, Part I.

As applied to warfare of organized defences these principles are elaborated and explained in S.S. 210, " The Division in Defence," which must be studied in conjunction with this manual.

1. *Duties in the defence.*—Machine gun units by reason of their great fire power and annihilating effect at medium and short ranges, should be considered as forming an important part of the framework of the defence.

They must be employed :—

(i.) To assist the infantry in the outpost zone to check and to disorganize a hostile attack.

(ii.) To defend the main battle position, should the enemy succeed in crossing the outpost zone.

(iii.) To check the advance of the enemy, whether forward or laterally, should he penetrate the main battle position.

(iv.) To assist the infantry and tanks in the execution of counter-attacks.

In order that the fullest value may be obtained from machine guns, it is necessary that the scheme of defence should be based upon the closest co-operation between the machine gun units and the other arms.

2. *The offensive spirit.*—The machine gun defence must invariably be imbued with the offensive spirit. A merely passive defence lowers moral and reduces efficiency. An active defence, embracing a carefully organized programme of harassing fire, as well as special enterprises in co-operation with the infantry and artillery, trains the gun detachments in their duties and ensures that the machine gun units will be ready to fire, and able to fire effectively, whenever an attack is launched by the enemy.

3. *Depth in defence.*—In allotting machine guns for defence, it is necessary to provide for their distribution in considerable depth, and to co-ordinate the action of the machine gun units as a whole with that of the infantry and artillery, so as to ensure that the enemy may be successfully engaged, irrespective of the direction of his attack. The actual depth to which the machine gun defence should be carried, should normally include the main field artillery positions.

4. *General distribution.*—In considering the application of the above principles to the distribution of machine guns in the defence, the guiding factor is the defence of the main battle position.

The bulk of the machine guns available with divisions holding the front, must be disposed so as to assist in the defence in depth of the main battle position, a portion of the machine guns being retained as a mobile reserve in order to support the action of the offensive reserves of the divisional sectors of defence.

The troops in advance of the main battle position have the rôle of outpost troops. Only a comparatively small proportion of the available machine guns, therefore, must be allotted for the immediate support of these troops ; the actual number to be allotted for this purpose can only be decided after a study of the ground. These guns should be employed to assist in the defence of the outpost line of resistance where this line is beyond the range of the enemy's trench mortar bombardment, and when the task cannot be performed adequately by Lewis guns.

5. *Disposition of guns.*—The disposition of the machine gun units in depth must be based upon definite plans for the restriction of the area into which an attacking force may penetrate. The units must be so disposed as to ensure the formation of a defensive flank in either direction in the event of a penetration of the defensive system at any point of tactical importance, and to support an immediate counter-attack for the recovery of the lost ground. They must also be distributed so that if the enemy succeeds in overcoming the resistance of some of the units, his farther advance may be checked by the units in rear until the necessary measures can be taken to restore the situation. In the organization of the machine gun defences, the closest co-operation is necessary between neighbouring corps and divisions.

If machine guns are sited near the front line, their detachments will be subjected to continuous annoyance by the enemy, and exposed to complete destruction in the event of a heavy bombardment, unless accommodated in deep dug-outs.

If machine gun detachments are accommodated in deep dug-outs near the front line, their chance of coming into action is small, since by the time they have manned their guns the enemy may have overrun the gun positions. The responsibility for holding the front line rests, therefore, with the infantry battalions and Lewis gunners, assisted from the rear by machine guns.

In exceptional cases, it may be desirable to place a few guns in the area liable to intense bombardments by the enemy's trench mortars, for the purpose of stiffening the defence of tactical localities, the capture of which would seriously affect the main defence in rear. This should only be done in cases where the localities cannot be covered by the fire of machine guns situated in the foremost limits of the main battle position.

In arranging for the defence of the main battle position, it will hardly ever be possible, nor will it be necessary, to cover the whole of the front with machine gun fire. The guns must be disposed with a view to the protection of strong points and of tactical features, such as valleys, spurs and ridges, along which the enemy may be expected to advance. The defence of the intervening spaces should be provided by the Lewis guns and rifles of the infantry.

The employment of machine guns singly must be avoided. If the machine gun defence were based upon the disposition of the guns singly, the loss of one gun might disorganize the whole system of defence. Guns should be employed in pairs or sections, in order to facilitate control and to inspire mutual confidence between the gun detachments.

A plan of the defensive system in a divisional or corps area, shewing the positions of machine guns, the area which each machine gun can cover by fire, and the most important line of fire in each area, should be prepared by the general staff of the formation responsible for the area.

6. *The rear system.*—In rear systems of defence, machine gun units may have to perform three different tasks. These are :—

(i.) To assist in stopping the advance of the enemy, and to compel him to make fresh dispositions for attacking the system.

(ii.) To undertake the machine gun defence of the system when it becomes the forward system of defence.

(iii.) To support any counter-attacks which may be made either from, or within, the system.

It is possible that restrictions of time and labour may prevent the rear systems of defence from being fully prepared in all details. Should the enemy penetrate rapidly into the defended area, many of the defences to be occupied in a rear system may be in the nature of improvised defences. In this case, full use must be made of villages, houses, woods, hedges, broken ground and ditches, in order to conceal the defensive dispositions.

FIGURE 4.—Reinforced Concrete Machine Gun Emplacement.
(For Two Guns.)

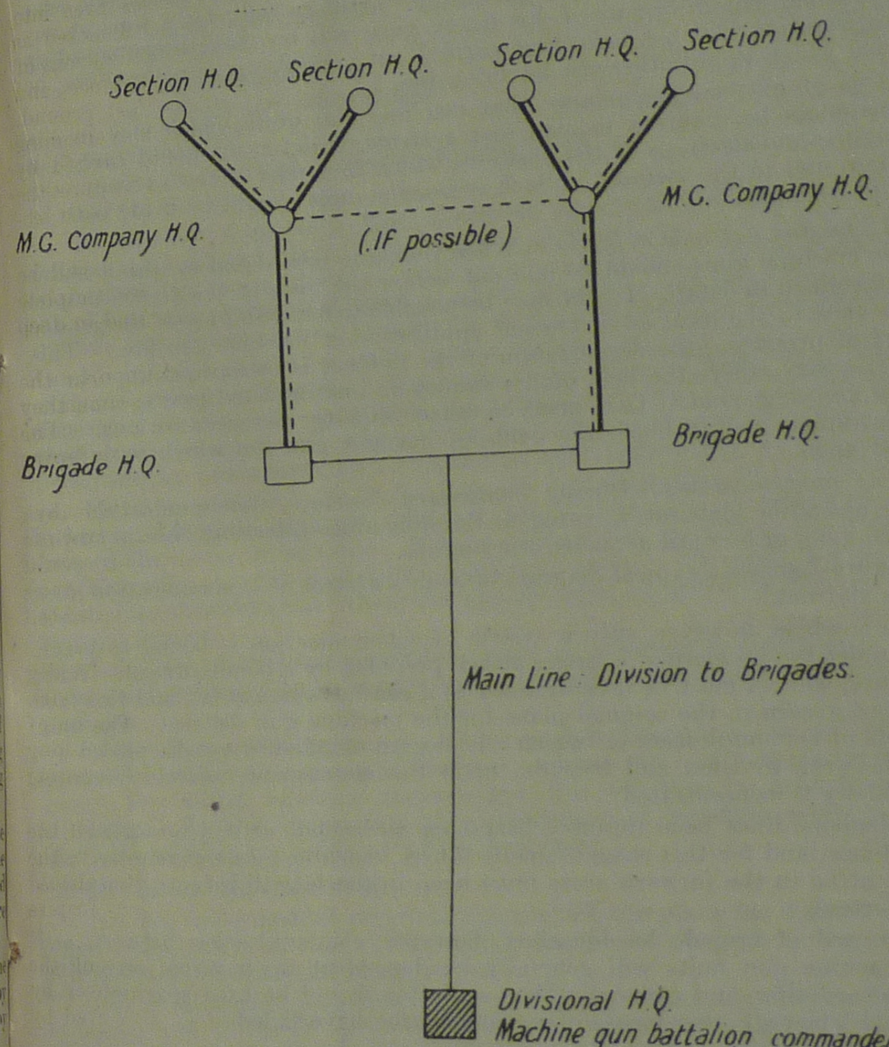


FIGURE 2.

This diagram shews a typical system of communications on a defensive front in stationary warfare. Communications are only shewn as far forward as the machine gun section headquarters situated in the main battle zone. Communications to machine gun detachments located forward of this (*see* Chapter IV., Section 21, paragraph 5) will be effected through the most convenient infantry battalions.

In this connection, it must be remembered that after penetrating for some distance into the defended area, the enemy's artillery will, for a time at any rate, be somewhat disorganized, his heavy guns will not have been moved up and registration will not have been carried out. Positions can, therefore, be occupied which would otherwise be untenable.

It is of extreme importance that machine gun units which may in any circumstances be required to man rear systems of defence, should carry out thorough reconnaissances of the positions which they may have to occupy, and of the ground in the vicinity. Such reconnaissances should be made both by day and by night.

7 *Laying out new defences.*—When planning new defences, the fields of fire for machine guns should be laid out before the lines of the trench system are determined in detail. It will then be possible to make full use of the ground with a view to the most advantageous application of machine gun fire. This method of preparing the organization of the defence is of especial importance in flat country where the field of fire cannot be increased by moving machine guns to higher ground. Care must be taken while the defences are in process of construction not to block the fields of machine gun fire which have been decided upon.

8. *Communications.*—During stationary warfare, communication by wire is apt to be elaborated, owing to the difficulties attending the control of machine guns in forward areas by other means.

Figure 2 shews a typical diagram of such a system of communication on a divisional front.

As a whole, however, such a system of communication is bound to break down under the pressure of a strong attack preceded by a bombardment. With its failure, control must be decentralized to a considerable extent, and this fact must be foreseen in the original plans for the machine gun defence. The only channels of communication on which any degree of reliance can be placed are those between division and brigade, upon the maintenance of which efforts must chiefly be concentrated.

Telephone lines from infantry battalions to brigade should be utilized, if in existence, and for this reason, among others, machine gun commanders who are operating in the forward areas must keep in touch with infantry battalion headquarters.

Forward of brigade headquarters, however, communication between and with machine gun units will generally be dependent upon visual signalling, mounted orderlies, and runners. The two latter should be used sparingly, and then only when all other means of communication have failed.

9. *Ammunition supply.*—In stationary warfare it is generally possible to provide ample ammunition for the guns. At least 16 belts should be allotted to guns in defensive positions for use in firing on their most important lines of fire. The extra amount necessary for guns detailed to carry out harassing fire, or overhead fire, will vary according to the rate of fire ordered, and the length of time for which it is required to be maintained.

A forward company ammunition dump, from which carrying parties can draw supplies for the guns, should be provided as far forward as it is possible to take limbers or pack animals.

Arrangements for drawing ammunition to replenish the forward company dump should be made by an officer of the company headquarters, generally the second-in-command of the company.

The supply of ammunition to the company should be made under battalion arrangements.

FIGURE 4.—Reinforced Concrete Machine Gun Emplacement. (For Two Guns.)

SECTION 22 : SITING OF MACHINE GUNS IN DEFENCE.

The siting of machine guns will be considered in this section under the following headings:—

(*a*) General principles.
(*b*) Direct and indirect fire.
(*c*) Control.
(*d*) Selection of positions on the ground.
(*e*) Summary.

1. *General principles.*—The allotment and siting of machine guns in defence must depend upon the nature and depth of the main battle position. In determining the positions of machine guns, it must be borne in mind that the enemy will probably attempt to effect penetration at the weaker parts of the line and will endeavour to take the stronger portions in flank or rear.

No attempt should be made to site machine guns so that every yard of ground is swept by their fire. The machine gun defence should be so combined with that of the Lewis guns that the former will play the part dictated by their characteristics, and will not be wasted in doing work which can be performed by Lewis guns, such as firing on small depressions or down trenches.

Machine gun fire should be reserved for protection on a larger scale, covering the more important features and denying to the enemy the most favourable routes of advance. It may be employed to stiffen the defence of areas already covered by artillery or trench mortar fire, and this should be taken into consideration when the general plan of machine gun defence is being drawn up.

Localities of tactical importance must be strongly covered, even though it becomes necessary to leave gaps on parts of the front where an attack is less probable.

Generally speaking, guns should be sited so that their fire will cover the ground on which the enemy is likely to present the best targets for machine guns. The killing effect of machine gun fire will thus be used to the best advantage. In this connection the importance of securing enfilade fire at medium and close ranges must not be forgotten.

2. *Direct and indirect fire.*

(i.) The fundamental principle upon which the plans for defence must be based is the power of the machine gun to arrest the progress of the enemy by direct fire at medium and close ranges.

(ii.) In addition, long range fire, preferably direct, can be used in order to harass and to break up troops advancing in close formation. It can also be used to assist in disorganizing the enemy during the opening stages of an attack if it is directed on to the most likely avenues of approach, or between the posts in the outpost zone. The use of long range fire lessens the possibility of machine gun detachments being overwhelmed by the enemy if his troops are advancing in such strength that there is not sufficient time to stop their progress by close range fire. The employment of long range fire, however, may be limited by :—

(*a*) The necessity for retaining at the gun positions a minimum of 4,000 rounds per gun for close range fire; and

(*b*) The undesirability of disclosing the gun positions.

(iii.) Indirect fire can be employed where it is not possible to deal with the target by direct fire. This may often be the case when targets which have to be engaged at long range cannot be seen from a gun position, or when smoke, mist or darkness prevent any target whatever from being seen.

Once the enemy has penetrated the defensive position, it will usually be impossible to engage him with indirect fire owing to the difficulties of observation of fire, and the uncertainty of his positions.

(iv.) Reliance cannot be placed upon a machine gun barrage for the purpose of stopping a determined attack on a large scale. The S.O.S. signal may not be seen; communications may fail; the enemy may cross the danger zone before the barrage can be put down, or mist, smoke or darkness may enable him to approach undetected.

It is not practicable for the opening of the artillery barrage to be utilized as a signal for the opening of the machine gun barrage, for the chief value of a machine gun S.O.S. barrage is the speed with which it can be applied, and its consequent disorganizing effect upon the attacking troops during the two minutes which generally elapse before the full weight of the artillery barrage can be developed.

On the other hand, a machine gun barrage, co-ordinated with the artillery, and directed on to ground over which the enemy's supporting troops are likely to pass, may hamper the arrival of reinforcements, and thus help to weaken the attack.

For the above reasons, the S.O.S. machine gun barrage must be regarded as of secondary importance. The justification for opening fire on S.O.S. lines will depend upon :—

(*a*) The ammunition supply (*see* paragraph (ii.) (*a*)); and

(*b*) The imminence of an infantry attack.

Where an S.O.S. barrage forms part of the defence scheme, every possible arrangement must be made beforehand for the rapid communication to the machine gunners of information of an impending attack.

(v.) All the considerations contained in the preceding paragraphs must be taken into account when working out the plan of machine gun defence, and it follows that all guns sited in fixed positions must first be disposed in depth with the object of defending tactical features with direct fire at medium and close ranges.

When this has been done, as many of these guns as possible should be utilized for long range fire—direct or indirect—according to circumstances. Guns so employed, therefore, will have two main lines or areas of fire.

(*a*) The more important line, for medium and close ranges; and

(*b*) The long range line, which may be an S.O.S. line.

As smoke, mist or darkness may obscure direct vision, all machine guns normally sited for direct fire must also be able to fire on their lines by indirect means if necessary.

3. *Control.*—In siting machine guns, it is important that the section commander should be able to retain control of his section; it also ensures the maintenance of moral and discipline.

The control of the guns forming a machine gun group by the group commander is limited by the fact that it is not possible to increase the number of signal lines within a division for the use of the machine gun battalion.

Communication with the majority of the units within a group can usually be effected only by means of temporarily laid (not buried) cable. This may serve in quiet sectors, but the intense bombardment prior to a hostile attack will usually destroy such cable.

FIGURE 4.—Reinforced Concrete Machine Gun Emplacement. (For Two Guns.)

In the defence, the siting of guns in sections or larger units, therefore, will be governed by the following considerations :—

(*a*) Depth in the defence must not be sacrificed in order that guns may be sited in sections, or units containing more than one section.

(*b*) The main rôle of the guns (the close defence of the main battle position) must not be impaired.

(*c*) Although the siting of guns in sections gives great advantages as regards control, ammunition supply, moral, etc., these advantages must be weighed against the fact that a section is more likely to be detected by aeroplanes and put out of action by artillery than separate pairs of guns some distance apart.

Subject to these considerations, guns may advantageously be sited in sections of 4 guns, more especially when they are at some distance from the front line.

4. *Selection of machine gun positions on the ground.*—Once the general distribution of the machine guns in the divisional defence scheme has been settled, and an approximate idea of their locations has been formed, it will be necessary to select the actual positions on the ground.

The following considerations must be taken into account :—

(*a*) An extensive range along the most important line of fire is essential : if possible, this range should not be less than 500 yards, for guns sited in pairs, and not less than 1,000 yards for guns sited in sections.

(*b*) The field of view should be as wide as possible, in order to enable the gunners to engage other targets when the most important area of fire is clear.

(*c*) When the configuration of the ground permits, positions should be chosen with a view to bringing enfilade fire at medium and close ranges to bear upon likely avenues of approach.

(*d*) All positions should, if possible, be capable of all round defence.

(*e*) As a general rule, the best way to protect an important feature by machine gun fire is to place the guns to a flank and away from the feature, rather than on or in the feature itself. This will facilitate the bringing of enfilade fire to bear on the enemy if he attempts an enveloping movement.

(*f*) No rule can be laid down as to the siting of machine guns in a clearly defined trench system. Guns sited in trenches are likely to come under concentrated artillery fire, but, on the other hand, they are more easily moved and visited in daylight.

Where a position can be sited in the open without any indications (*e.g.*, tracks to the position, traces of work, shadows, etc.) being afforded to the enemy either from the ground or from the air, it may escape deliberate shelling at the outset of the attack, and the field of fire will be less restricted, especially in flat country.

The nature of the emplacement must also be considered (*see* section 25 of this chapter).

(*g*) Provided that a reverse slope affords the required field of fire, it possesses certain advantages for machine gun positions, and approaches will not, as a rule, be subjected to ground observation.

For guns in rear positions, however, where concealment is less difficult, a forward slope is generally preferable, as it affords a longer field of fire.

It is often possible to find positions in rear of a spur from which a long field of fire to either flank may be obtained.

(*h*) In undulating country, valleys which lead from the enemy's positions will form likely avenues of approach. Machine guns should be posted at the heads or along the sides of such valleys, so as to command them.

When there is a valley which the enemy must cross in his advance, positions for the guns should be found from which it is possible to bring fire to bear on the enemy as he is crossing the ridge to descend into the valley, and also to enfilade the bottom of the valley.

(*i*) A gun should not be sited near a conspicuous or obvious landmark (*e.g.*, an isolated ruin, an isolated clump of trees, cross roads, trench junction, etc.), nor should a position be chosen which is likely to be subjected to the enemy's artillery barrage.

(*j*) Machine guns may be sited in the cellars of a group of ruined houses, as it will be difficult for the enemy to locate their exact positions. Similarly, a large wood lends itself to defence by nests of machine guns as the foliage and undergrowth give ideal facilities for concealment, even of comparatively large field works. The advance of the enemy should be diverted by well arranged obstacles and, if necessary, clearings, which are swept by machine gun fire.

In woods, valleys or depressions gas is particularly dangerous. When, therefore, guns are sited in such areas, the most stringent precautions must be taken against the effects of gas.

(*k*) Wire obstacles sited in connection with machine gun fire, may be classed as "tactical" or "defensive." Tactical wire should be carefully sited, with the object of forcing the enemy into definite areas or along routes upon which concentrated machine gun fire can be brought to bear. Defensive wire is that which is sited in order to afford local protection to machine gun positions: it is not necessarily covered by fire. It is not advisable to site a machine gun position at the apex of a wire entanglement, as the enemy is bound to suspect its presence. Only dummy emplacements should be constructed at such points; the actual gun should be in a concealed position to a flank or in rear.

(*l*) In selecting a position due regard must be had to its concealment both from ground observation, and from the air. The principles of camouflage are contained in S.S. 206, "The Principles and Practice of Camouflage," with which every machine gun officer should be familiar.

Combined with the skilful use of natural and artificial camouflage, mobility, alternative positions, frequent changes of position (where practicable) and dummy positions should all be employed to deceive the enemy's observers.

When a position is selected on a forward slope, there should be some covered approach by which access to the gun may be maintained.

Traces of occupation of an isolated position are difficult to avoid; during the day it will often prove advisable for the gunners to live at some little distance from the gun position, if they can reach it by a disused trench or some covered approach.

Sniping by machine guns should be avoided, as it may disclose the positions. Guns should not be fired prematurely from the positions which they will occupy in the event of an attack.

FIGURE 4.—Reinforced Concrete Machine Gun Emplacement. (For Two Guns.)

(*m*) When in action, machine gun detachments must take steps for their own local protection. Any dead ground or concealed approaches to their positions must be kept under continuous observation by sentries or frequently patrolled. If a machine gun commander is unable to provide for his own local protection, it is his duty to apply to the nearest infantry commander for a suitable escort, and it is the responsibility of that infantry commander to provide it.

Every machine gun detachment should have with it the means for destroying the gun should necessity arise. A bomb placed on the breech casing is sufficient.

At each gun position, there should be an order board (*see* Appendix) with certain definite instructions for the gun detachment. It is the duty of the machine gun commander on the spot to ensure that these instructions are thoroughly understood by each man of the detachment.

5. *Summary.*—To sum up, the siting of machine guns in the defence must be based on the following considerations :—

(i.) No attempt should be made to sweep every yard of ground by machine gun fire. Fire must be directed on to areas over which the enemy will probably advance, and must be utilized for the defence of important tactical features, preferably obliquely or in enfilade.

(ii.) All guns must be sited for the employment of *direct* fire at medium and close ranges, and a reserve of at least 4,000 rounds per gun in filled belts must be maintained at the gun position for this purpose.

(iii.) Long range fire, either direct or indirect, can be employed to harass and to disorganize the enemy, but the primary duty of machine guns is that given in the preceding paragraph. The field of fire should be as wide and as deep as possible, in order that the greatest use may be made of long range fire on suitable targets. This applies especially to guns sited in sections.

(iv.) Machine guns should rarely be sited singly, and then only for a specific purpose.

(v.) The more forward guns should generally be sited in pairs, as this will facilitate control, tend to maintain moral, and enable one gun to carry on the task in the event of the other gun being put out of action.

(vi.) Guns farther in rear can usually be sited in sections, but due regard must be paid to the considerations given in section 22 of this chapter.

(vii.) Few guns, if any, should be placed in the most forward area, i.e., the area which is liable to be subjected to an intense trench mortar and artillery bombardment. The defence of this area must be entrusted to the Lewis guns and rifles of the infantry.

(viii.) Whenever possible, gun positions must be prepared for all round defence, so that the gun detachments can defend their position if the enemy attacks it from any direction.

(ix.) Guns in rear can often be sited so that their fire will protect the flanks of the more forward guns, but this is a secondary consideration, and must not restrict local defence by direct fire at medium and close ranges.

(x.) The importance of adequate cover for the gun detachments must be remembered. It is not sound to select gun positions for a good field of fire in an area which is likely to be subjected to an intense bombardment unless adequate protection is provided within a short distance of the gun position.

(xi.) Liaison between the engineers and machine gunners must be maintained in order that the most effective use may be made of obstacles and field works.

SECTION 23 : TACTICAL HANDLING.

1. *General considerations.*—Once the enemy has launched an attack on a large scale the action of the machine guns, other than those in reserve, will be governed by the tasks allotted to them beforehand in the divisional plan of defence.

The failure of all telephonic or telegraphic communication with the more forward gun detachments must be anticipated. Machine gun defence in the forward area will probably develop into a series of minor actions each involving the most stubborn defence of important tactical features. If the gradual withdrawal of the more forward gun detachments is ordered, their movements should be covered by the fire of the mobile Lewis guns. On the other hand, if the retention of any feature is considered vital, the machine gun detachments responsible for its defence will resist to the last. So far as they are concerned, any position they are ordered to defend is " vital " and must be held until they receive orders to withdraw. As long as machine gunners are still holding out, no position can be regarded as lost, and the delay thus caused to the enemy's attack may gain time for the development of a successful counter-attack.

In order to overcome the difficulties caused by loss of communications, and to obtain information as to the dispositions of the defending and attacking troops, active reconnaissance must be carried out and close liaison maintained by the machine gunners with the artillery and the infantry.

2. *Action in the event of penetration of the defensive system.*—Although the enemy's advance does not necessarily entail the withdrawal of machine gun units, it may happen that such a withdrawal has to be carried out to conform with the movements of troops on the flanks. It is essential, therefore, that plans for a possible withdrawal should be prepared beforehand. A rehearsal should, if possible, be carried out with those Lewis gun detachments which are detailed to co-operate with the machine gunners. Alternative positions should be prepared and routes selected.

The success of any such operation will depend upon:—

(i.) The plan being communicated to, and thoroughly understood by, all concerned.

(ii.) Close liaison between machine gun, infantry and artillery commanders.

(iii.) The determination of all ranks that the enemy must be made to suffer heavy casualties for any gain of ground which he may make.

When moving from one position to another, machine gun detachments must be assisted by covering fire from the infantry, as machine gunners cannot move their gear and use their rifles at the same time. In a withdrawal, the infantry escort forms an important factor in successful machine gun work.

FIGURE 4.—Reinforced Concrete Machine Gun Emplacement. (For Two Guns.)

3. *Action of the Reserves.*—The action of reserve machine gun units and companies in the defence requires consideration. Normally, these reserves, if not already occupying positions in a rear system of defence, will be sent up to man such positions as soon as it is clear that a hostile attack has been launched. It may be assumed that in a determined hostile offensive on a large scale, the enemy may succeed in penetrating the front in places and that counter-attacks will be necessary.

In all plans for counter-attack, whether drawn up beforehand or made on the spur of the moment, the covering fire of machine guns, preferably firing direct and from a flank, must be included.

Previous reconnaissance in close conjunction with infantry brigade commanders should enable machine gun commanders to determine approximately the areas in which counter-attacks may have to be delivered. They will then be able to select positions from which direct observation of the counter-attacks may be possible.

To enable the reserve machine gun units to be used at the right time, the machine gun battalion commander must arrange for direct observation of the progress of the battle. For this purpose, liaison officers should be with the forward brigade headquarters of each brigade in the line.

The necessity for moving forward machine gun reserves will be indicated by information received from the front, but the decision for their employment must rest with the divisional commander. In the handling of these reserve units, the tactical use of limbers, whenever possible, is of the greatest importance.

In addition to the reserves considered above, there may be machine gun reserves in the hands of corps and army commanders. These reserves should be used on the same principle as above stated, though in a wider sense.

SECTION 24 : DUTIES OF MACHINE GUN UNITS WITH A REAR GUARD.

The same system of allotment and command applies to the machine gun units with a rear guard as apply in the case of an advanced guard (*see* Chapter III., Section 20, paragraph 1). As a rear guard will usually be required to hold positions with the minimum number of men, a large proportion of machine guns should be allotted to it.

Experience has shewn that well-placed and skilfully handled machine guns can, with the support of a small number of infantry, check for long periods the advance of comparatively large numbers of troops.

The principles upon which all rear-guard action should be based are laid down in Field Service Regulations, Part I, Sections 71, 72 and 73.

In the application of these principles, the following points in connection with the employment of machine guns should be noted :—

(*a*) Direct fire should be used at the longest possible ranges, with due regard to the supply of ammunition.

(*b*) Machine guns should be disposed mainly on the flanks.

(*c*) Guns should be handled in sections as far as possible.

(*d*) Defence in depth must be maintained by the retirement of alternate sub-sections or sections.

(*e*) Guns should be sited with due regard to the prospects of ultimate withdrawal.

(*f*) Full use should be made of limbers and pack animals for withdrawal, as well as for forming ammunition dumps in suitable places near positions on which the guns will fall back. Concealed dumps of S.A.A. and water will be required for such gun positions.

(*g*) Surprise effect must be sought, but the necessary concealment must not interfere with the mobility which is necessary to ensure that successive withdrawals occupy the minimum amount of time.

While the withdrawal of machine guns should not take place until the latest possible moment consistent with the tactical situation, the necessary arrangements should be foreseen and prepared.

These arrangements will involve:—

(*a*) The previous selection of positions in rear. If these positions can be sited so as to cover the flanks of the more forward guns, additional power will be given to the defence.

(*b*) The reconnaissance of covered lines of withdrawal.

(*c*) The close proximity and full use of limbered wagons and pack transport.

While, as a general principle, a portion of the machine guns should be left in rear to cover the withdrawal of the bulk of the infantry, it is essential that parties of cavalry or infantry should remain to cover the withdrawal of the machine guns.

In a withdrawal, the closest co-operation is necessary between machine gun and infantry units. Otherwise, when orders to withdraw are received by the infantry, they may not be communicated to the machine gun units. This omission may result in the guns being left in their old positions until it is impossible to withdraw them owing to the lack of any covering fire. By reason of their mobility, Lewis guns are suitable for covering the withdrawal of machine gun units. As soon as the bulk of the infantry has withdrawn and re-organized on its new position, a proportion of the machine gun units which have covered the withdrawal should be released to take up fresh dispositions in depth.

SECTION 25 : MACHINE GUN EMPLACEMENTS.

1. *General Remarks.*—A number of types of machine gun emplacements are now in use and each type has its particular function.

The following types of emplacement are described in this section :—

(i.) A reinforced concrete emplacement, which generally is provided with two loopholes, and affords accommodation for the detachment.

(ii.) A "Champagne" shell hole emplacement which gives dug-out accommodation for the detachment.

(iii.) The "Moir" pill box emplacement, which has cover for the detachment either in splinter proof shelters or in dug-outs.

(iv.) Open emplacements.

The areas in which emplacements are required may be divided into:—

(i.) An area which is not normally liable to shell fire, *i.e.*, an area which cannot be shelled by guns other than H.V. guns, until the enemy has moved forward his guns or trench mortars.

(ii.) An area which is normally liable to shell fire, *i.e.*, an area from 5,000 to 6,000 yards behind the front line. In this case a distinction must be made between areas which are, and which are not, under direct observation from the enemy's observation posts; and between localities which are within and without the normal zones of concentrated bombardment.

The general rules for the siting of machine guns given in Chapter II., section 9, and chapter IV., section 22, apply equally to the siting of machine gun emplacements, which should invariably be carried out by a machine gun officer working in close co-operation with the engineers to ensure continuity of plan.

FIGURE 4.—Reinforced Concrete Machine Gun Emplacement. (For Two Guns.)

2. *Reinforced concrete emplacement.*—This may be either a monolithic (Figure 3) or a concrete block structure (Figure 5). The former is the stronger, but has the disadvantage that nearly all work has to be carried out on the site. It consequently takes very much longer to construct than the block structure. The quantity of material and transport required for the construction of a reinforced concrete emplacement is very great, and it is essential, therefore, that the use of such emplacements should be confined absolutely to areas in which no more economical form of emplacement can be used.

Concrete emplacements will usually be required:—

(*a*) In an area normally liable to shell fire, when the gun positions are under direct observation from the enemy's observation posts and when the nature of the soil will not permit of Champagne emplacements being constructed; and

(*b*) Within the normal zone of concentrated bombardment, where it is essential that good shell proof cover should be provided for the guns and detachments. Gun positions should not be selected in such areas if it can be avoided.

In an area normally liable to shell fire which is under the enemy's direct observation, it will generally not be advisable to construct a concrete emplacement within about 3,000 yards of the front line. In such positions the block type of emplacement should always be used on account of the comparative rapidity with which it can be erected. If the site is not under direct observation, either type of emplacement can be used, but the site must be carefully camouflaged before work is begun and every precaution must be taken to prevent the discovery of the position.

Concrete emplacements can also be used in areas not normally liable to shell fire where it is desired to provide exceptionally strong protection for the guns and detachments.

It is essential in all cases that the site should be within easy reach of a tramway or a good road.

The reinforced concrete emplacements shewn in Figures 3 and 5 are not completely proof against a direct hit by a 6″ shell at the most favourable angle of impact. They are absolutely proof against anything less than a 6″ shell, and are proof against a 6″ shell in the majority of cases. A direct hit by an 8″ shell will probably destroy the emplacement, but the effect of an 8″ shell bursting 2 or 3 feet from the emplacement is not likely to be serious.

As a general rule, these emplacements should be loopholed to enable guns to cover the most important area of fire.

Whenever possible, open emplacements should be provided in front and in rear of concrete emplacements. Guns can then be brought outside the concrete emplacements and fired in any direction. An alternative arrangement is to construct a mounting for the gun on the top of the concrete structure. (Figures 3 and 13.)

At least one alternative open emplacement should be provided which can be occupied in case the concrete emplacement is so heavily shelled as to render it untenable. This should be located at a sufficient distance from the concrete structure to escape the effects of the shelling.

3. *Champagne type emplacement.*—The emplacement itself (Figure 6) is merely a rectangular pit with revetted sides. A wooden platform is provided with a trap door giving access to the dug-out below. Emplacements of this type are generally constructed in pairs communicating with a single dug-out. But, in order that the gun detachment may reach the emplacement without delay, the distance between the emplacements constructed in pairs should not exceed 35 yards.

This type of emplacement can only be used in localities where the water level admits of the construction of dug-outs. It is especially suitable for employment in an area normally liable to shell fire, more particularly in sites under direct observation from the enemy's observation posts, as it is invisible to ground observation and easily camouflaged from the air. When under direct observation, it is most undesirable that any splinter proof cover should be provided, as it may disclose the emplacement and render it more difficult to remove casualties. A wounded man lying in the emplacement would seriously impede the work of the gun detachment and might block the exit from the dug-out, while the splinter proof cover may be destroyed by shell fire and so render exit from the dug-out difficult or impossible.

In the area not normally liable to shell fire, Champagne emplacements are also most valuable, but their construction involves the use of much material and labour, and they should only be used to protect points of special tactical importance. They should be used in preference to concrete emplacements wherever possible.

4. *Moir Pill Box.**—This emplacement (Figure 8) consists of a circular concrete block wall, supporting a dome from which is suspended a revolving steel bullet-proof shield. The gun is carried by a special mounting attached to the shield. By the addition of concrete on the dome and round the blind wall, the emplacement can be made practically proof against field gun fire, and completely proof against rifle or machine gun fire. It cannot be made in any way proof against 6″ shells, but will not, if suitably protected, be affected by a shell of that calibre bursting 3 feet or more from it.

This pill box is suitable for use in an area not normally liable to shell fire, where it will, in the first instance, be exposed only to fire from field guns and machine guns. Against these it provides practically complete protection. The question of provision of accommodation for the detachment in this area will depend upon whether the pill box will normally be occupied or not. In fixing sites it is essential to avoid localities, such as positions in the neighbourhood of trenches or houses, which are likely to be shelled.

In an area normally liable to shell fire, this pill box can only be used in localities not under direct observation from the enemy's observation posts. It is further undesirable to use it in localities within the normal zone of concentrated bombardment or near places which are likely to be shelled, unless circumstances preclude the construction of a form of emplacement, such as the Champagne or concrete emplacement, which is better suited for use in such a zone. Whenever used in an area liable to shell fire, cover for the detachment must be provided. This will usually take the form of a splinter proof shelter (Figure 13), either connected with, or immediately in the vicinity of, the emplacement.

* No experience has been gained with regard to this pill box in battle owing to the fact that it has only recently been constructed (July, 1918).

FIGURE 4.—Reinforced Concrete Machine Gun Emplacement.
(For Two Guns.)

The value of this emplacement lies largely in the fact that it is easily concealed from air observation and photography (Figures 9 to 12), and possesses an all-round traverse. It is essential, therefore, that the greatest care be taken to camouflage the site before erection, and to maintain the camouflage later. This applies equally to any shelter erected in connection with the emplacement, and especially to entrances both to the emplacement and the shelter. Concealment from ground observation (Figures 9 to 12) can frequently be obtained by locating the emplacement in a hedge, or by the transplantation of bushes, grass, etc., to form a screen. Dummy pill boxes can be easily constructed.

It is not desirable to use the Moir pill box in conjunction with a dug-out as in the Champagne type. If it is proposed to provide accommodation for the detachment in a dug-out, the exit from the dug-out should not lead directly into the emplacement, but should be connected with it by a short length (about 6 feet) of trench, which must be most carefully camouflaged.

5. *Open Emplacements.*—These are required in forward areas when it is impossible to construct either the Champagne type or the concrete emplacement, and when the Moir pill box cannot be erected. When constructed in isolated positions away from trenches, the emplacement should be in the form used in the Champagne type. When located in a trench system, all that is required is a platform on which the gun mounting can stand. In both cases, the emplacement must be camouflaged from overhead observation.

For the construction of open emplacements in conjunction with concrete emplacements, *see* paragraph 2.

Dimensions for firing platforms and loopholes are shewn in Figure 14.

CHAPTER V.

THE EMPLOYMENT OF SPECIAL UNATTACHED MACHINE GUN UNITS.

There are certain special machine gun units which form part of the army troops.

1. Army troops machine gun units consist of :—
   (*a*) Machine gun battalions with horse transport.
   (*b*) Machine gun battalions with motor transport (lorries).
   (*c*) Motor machine gun brigades (on side-car machines).

2. These units constitute a valuable reserve of fire power which can be transferred rapidly from one part of the battle area to another, and can thus participate at short notice in offensive or defensive operations as the occasion may demand.

The radius of action of these units varies since their transport is dissimilar, and due allowance must be made accordingly when considering their tactical employment.

3. Machine gun battalions with horse transport are identical with divisional machine gun battalions, and they are employed in a similar manner.

4. Machine gun battalions with motor transport (lorries) possess great mobility as long as the guns remain in the lorries. The movement of the lorries must depend upon the nature and condition of the roads. Once the gun detachments have left the lorries, their mobility is less than that of infantry, and the difficulty of maintaining the supply of ammunition from the lorries to the gun positions increases with the distance of the guns from their lorries. On the roads in advanced areas, the column is vulnerable, and to block its movement is a comparatively easy matter. These battalions cannot be regarded as interchangeable with divisional machine gun battalions. It follows from the above considerations that their main use will be in a defensive battle as a mobile reinforcement for threatened portions of the front.

5. A motor machine gun brigade with the gun carried on easily manœuvred side-car combinations does not possess in equal degree the disadvantages mentioned in paragraph 4. The machines can be driven over relatively poor roads, and occasionally over open country. They are far less conspicuous on the march, and can pass through congested traffic.

6. The main uses of these army troops machine gun units may therefore be summarised as follows :—

(*a*) To increase the volume of initial covering fire of divisional machine gun units when an advance is checked by strong enemy resistance.

(*b*) To afford rapid protection to a flank which has become exposed.

(*c*) To exploit a success by pushing forward to seize points on the enemy's communications, both rail and road, and thus to disorganize his staff arrangements and his means of reinforcement.

(*d*) Acting with advanced guards to :—

(i.) Support the advanced cavalry and secure points of tactical importance.

(ii.) Break up hostile patrols and interfere with the enemy's reconnaissance work.

(iii.) Carry out long distance reconnaissances.

Owing to their mobility, opportunities may also occur for their employment with rearguards. Their rôle will then be to remain behind and to delay the enemy as long as possible.

7. In order to be effective, the action of these units when detailed to operate in advance of the infantry, must be characterized by the utmost boldness and dash.

FIGURE 4.—Reinforced Concrete Machine Gun Emplacement. (For Two Guns.)

CHAPTER VI.

MACHINE GUNS WITH CAVALRY.

1. Machine gun support for the cavalry is the special duty of machine gun squadrons. The principles for the employment of cavalry machine guns laid down in "Cavalry Training," Sections 225 and 236, hold good, with the exception of section 225, section 227, paragraphs 1 and 2, section 228, paragraph 2, line 1, and section 230, paragraph 4.

The following remarks are to be read as supplementary to, and not in substitution for, the above sections.

2. The general tactical principles laid down in the foregoing chapters of this publication hold good in cases where cavalry is employed on foot. Machine gun squadron commanders, therefore, should be thoroughly familiar with these principles.

3. The following are the main points peculiar to the employment of machine guns with cavalry :—

(*a*) *Need for rapidity.*—As rapidity is the essence of all mounted action and quickness of decision is necessary for success, it is of the utmost importance that officers of machine gun squadrons should have a thorough knowledge of cavalry tactics, and that their men should be highly trained.

(*b*) *Command.*—The machine gun squadron forms an integral part of each cavalry brigade, and the brigade commander is accordingly responsible for the distribution of guns and allotment of tasks within the brigade.

In this respect he is in the same position as a commander of an advanced or rearguard as considered in Chapter III., Section 20, and Chapter IV., Section 24.

(*c*) *Co-operation.*

(i.) In order to ensure co-operation, the machine gun commander must keep in the closest touch possible with the commander of the troops with whom he is acting. Thus, the machine gun squadron leader should ride with the brigade commander, and the section and sub-section leaders should keep in close touch with the commanders of units to which they may be attached.

Section and sub-section commanders, as opportunities arise, must act on their own initiative and not await orders. It will often be impossible for commanders to keep sub-section officers informed of orders and movements in quickly moving open warfare.

(ii.) Machine gun units must also co-operate with one another. To ensure this, the machine gun squadron commander must always endeavour, both before and during an action, to keep his sub-section officers fully informed of each other's orders and movements, and subordinate machine gun commanders must neglect no opportunity of getting into touch with one another during the course of an action. Similarly, all machine gun commanders will be responsible for gaining touch and fighting in co-operation with machine gun units acting on their flanks.

4. *Protection and Reconnaissance.*—The rule that the commander of every body of troops is responsible for his own protection applies to machine gun commanders. Since, however, owing to lack of personnel, a machine gun

commander is unable to detail reconnoitring and protective detachments from the men under his command, his responsibility is limited to the duty of making a request to the cavalry commander under whose orders he is, for such special reconnaissance and protection as the situation may demand. This must not, however, be interpreted as in any way relieving him of his responsibility for carrying out the personal reconnaissances which form an important part of the duty of every machine gun commander.

5. *The Approach March.*—On account of the necessity for careful reconnaissance and concealment, and owing to the characteristics of their weapon, machine gunners take longer to come into action than cavalry. Accordingly the normal position of the machine gun unit during the approach march should be near the head of the column. The unit must adhere to cavalry formations as much as possible in order to conceal the presence of machine guns.

6. *Distribution of Machine Guns.*—In actual fighting, a machine gun squadron will rarely be employed as a unit. Machine guns will be distributed among the units of the brigade, the allotment of guns being governed by the following considerations:—

(*a*) Sub-sections should not be broken up. Machine guns are used with best effect in pairs, and in machine gun squadrons the sub-section is organized with a view to its employment as a unit.

(*b*) Generally, as many guns as possible should be kept under the immediate control of the brigade commander. It must be remembered that once machine gun sections or sub-sections have been detailed to accompany detached units, it may not be easy to recall them should they be needed elsewhere.

(*c*) When, however, a cavalry unit is detached or is working as an advanced, flank or rear guard, a section or sub-section of machine guns should be attached to it in order to enable it to deal quickly with the enemy's machine guns, to form pivots on which the cavalry can manœuvre, and to keep the enemy's attention engaged while troops are moving round his flanks.

7. *Machine guns in Action.*

(*a*) Where it is necessary to place a machine gun in a position which it is not possible for mounted men to approach, it will generally be found practicable for the gun numbers or pack leaders to dismount and lead up the gun and the first ammunition pack animals to the position. Cover can usually be found for single horses.

(*b*) When time allows and tools are available, guns should be dug in. It should be borne in mind, however, that cover from view often gives better protection than a hastily dug emplacement which may attract the enemy's attention. Positions should, whenever possible, be camouflaged. (*See* Chapter IV., Section 22).

(*c*) When guns are in position, the machine gun commander must allot targets and give general fire orders, but he should not himself attempt to control the fire. Each detachment leader must control the fire of his own guns, thus enabling the machine gun commander to remain free to watch the general situation, to make and to receive reports, to maintain touch with his superior commander and with the troops with whom he is operating, and to appreciate and to conform to any change in the tactical situation.

FIGURE 4.—Reinforced Concrete Machine Gun Emplacement. (For Two Guns.)

APPENDIX.

Specimen Order Board for a Machine Gun Position.

GUN POSITION NUMBER.....

This card must be filled in and kept up to date by the officer in charge of this gun.

1. S.A.A. to be maintained at this position :
2. S.A.A. to be reserved for close range fire :
3. Supplies of S.A.A. can be obtained from :
   ,, Water ,, ,, ,,
   ,, Oil ,, ,, ,,
   ,, Grenades ,, ,, ,,
4. The positions of, and the ranges to, the following places must be known by every man of this gun detachment :
5. The area which this gun has to defend by close range fire is :
6. Long range fire can be brought to bear on :
7. The S.O.S. line for this gun is : direction :—
   elevation :—
8. Special precautions during mist, smoke, fog, or darkness :
9. Special orders if the enemy attacks :
10. Alternative emplacements for this gun will be found at :

Every man of this gun detachment must know the following :—

(*a*) The S.O.S. signal.

(*b*) The sleeping quarters of his officer, N.C.O., and the rest of the gun detachment.

(*c*) Where the enemy lines are.

(*d*) The location of the machine guns on either side of this position and where they will fire if the enemy attacks.

(*e*) The positions of section and company headquarters.

(*f*) The position of the nearest regimental aid post.

(*g*) The position of the nearest telephone.

(*h*) The place where gun charts and range cards are kept.

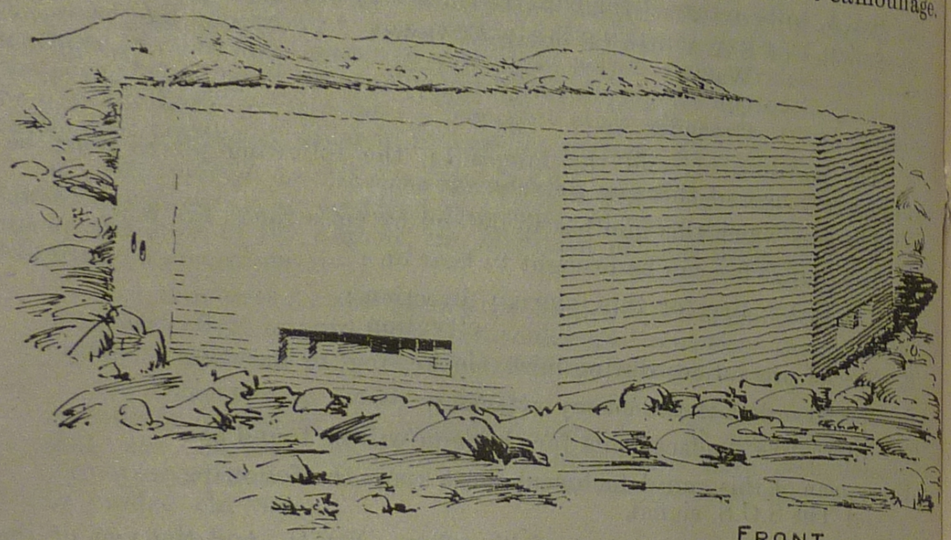
(*i*) What action to take in case of a gas alarm.

(*j*) The points of the compass.

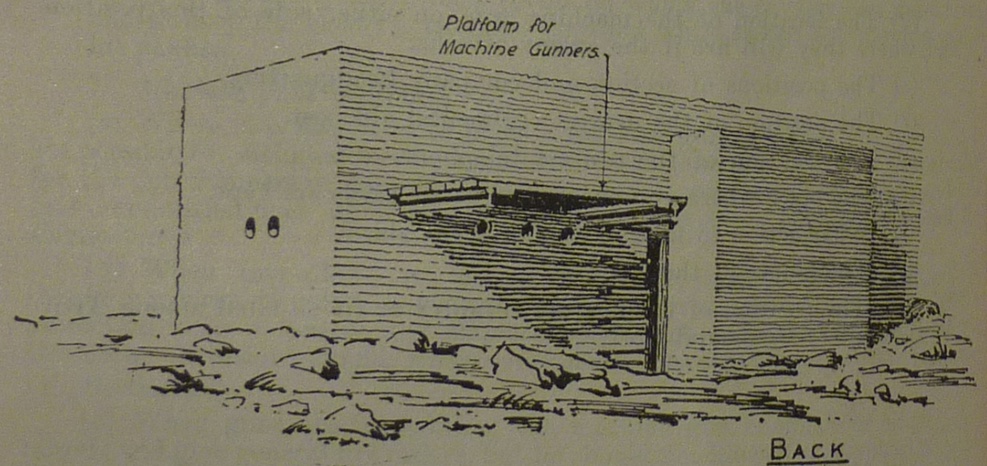
(*k*) The position of the nearest Infantry or (if situated among Artillery) Artillery Command Post.

FIGURE 3.—Reinforced Concrete Machine Gun Emplacement.
(For Two Guns.)

Perspective sketches to shew general appearance without camouflage.



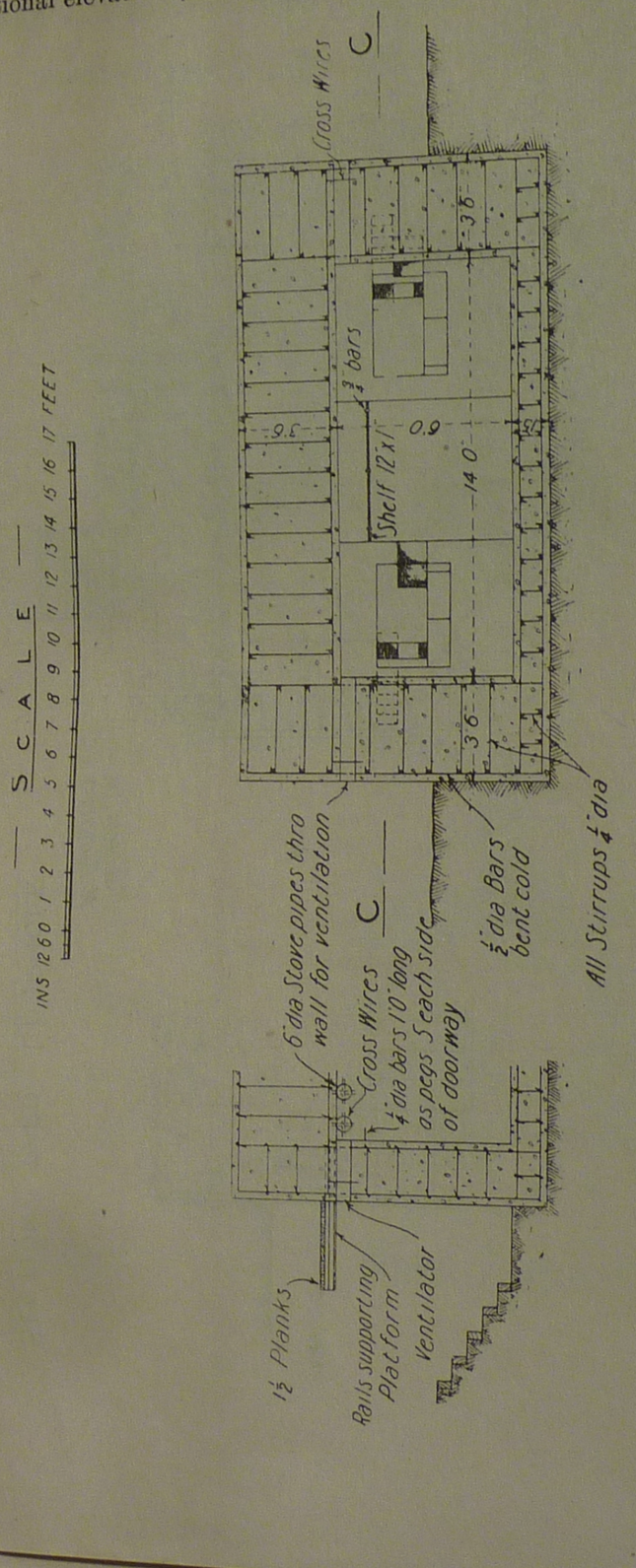
FRONT



BACK

FIGURE 4.—Reinforced Concrete Machine Gun Emplacement.
(For Two Guns.)

Sectional elevations, and plan shewing main constructional details.



SECTION AT A-A

SECTION AT B-B

range-takers and instrument

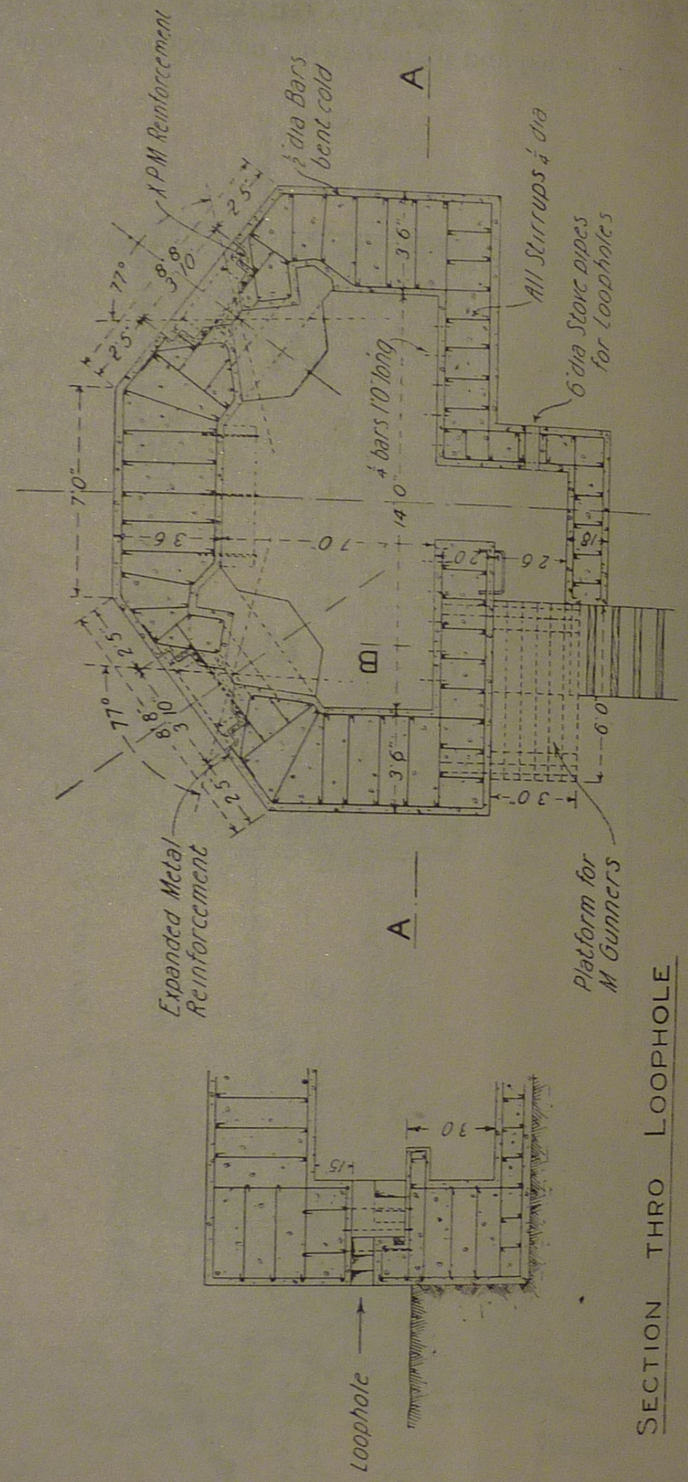
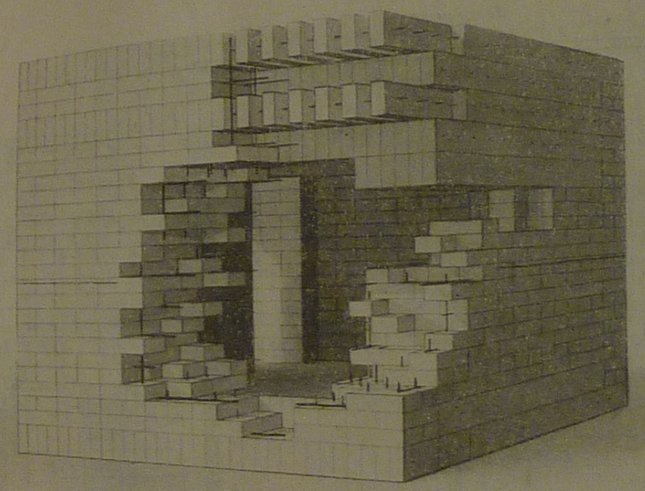


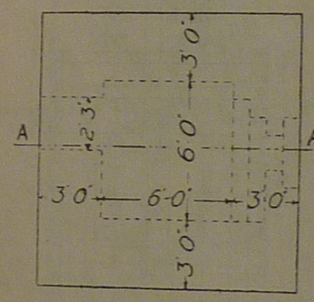
FIGURE 5.—Concrete Block Machine Gun Emplacement.

Perspective sketch, plan, and sectional elevation.

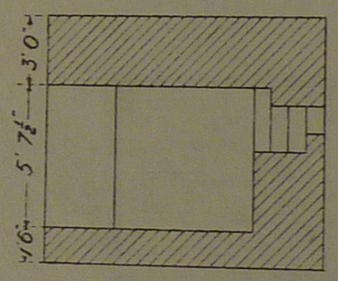


PERSPECTIVE SKETCH

(Corner removed to show reinforcement)



PLAN



SECTIONAL ELEVATION AT A-A

range-takers and instruments."

FIGURE 6.—"Champagne" Machine Gun Emplacement.

Sectional elevations and plans to shew constructional details of one sh
with an open machine gun emplacement.

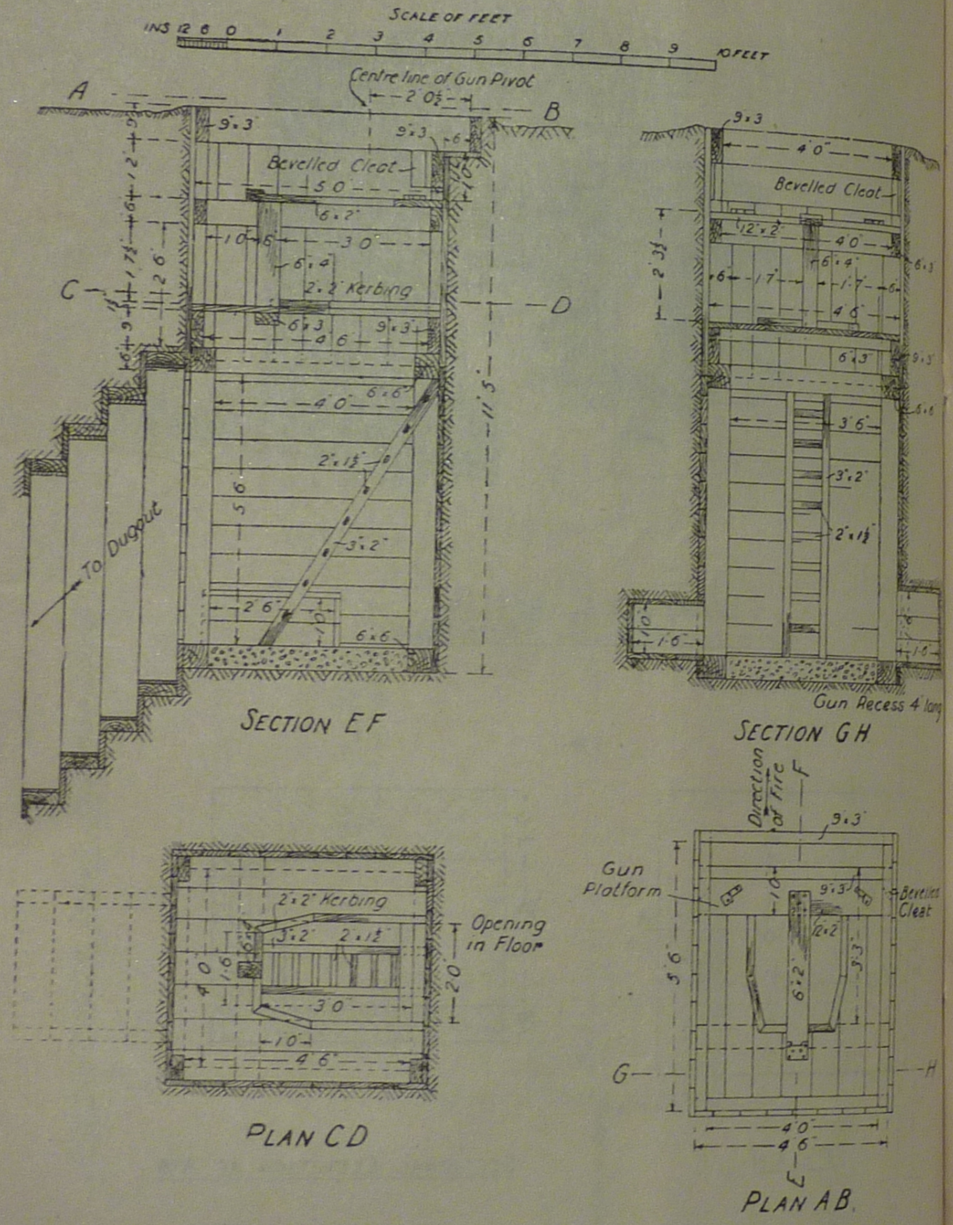
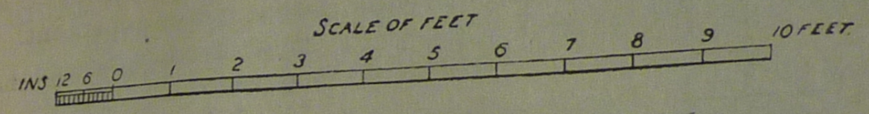
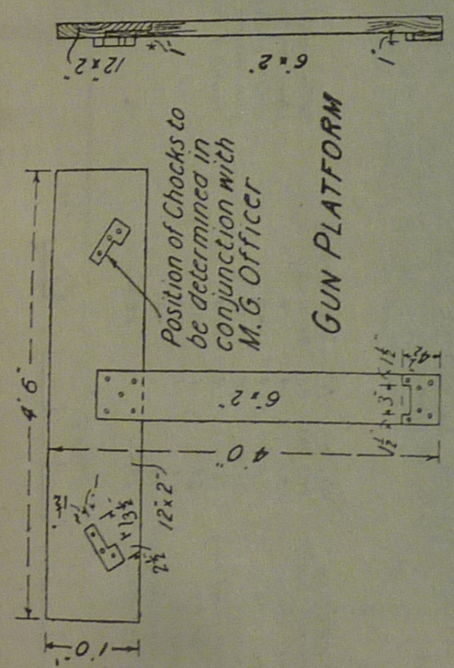
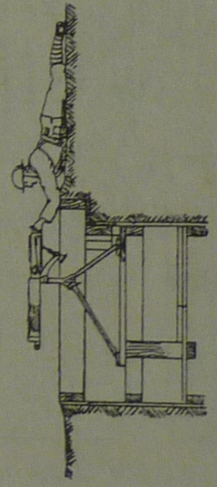


FIGURE 7.—Details of "T-Base" for the Open Machine Gun Platform of a Champagne Emplacement.



MATERIAL LIST		
4 Lengths	5'6" long x 6"x6"	
4	5'0" "	6"x6"
4	4'6" "	6"x6"
2	4'6" "	9"x3"
2	3'6" "	9"x3"
2	5'0" "	6"x3"
3	4'6" "	6"x3"
4	2'6" "	6"x3"
2	5'9" "	9"x3"
3	4'6" "	9"x3"
1	2'1½" "	6"x4"
Gun Platform	3'6" "	6"x2"
"	4'6" "	12"x2"
Chocks	1'0" "	6"x1"
Floor Kerbing	10'0" "	2"x2"
Ladder	13'6" "	3"x2"
" Rungs	8'0" "	2"x1½"
Logging	260 Sq ft	1½" thick

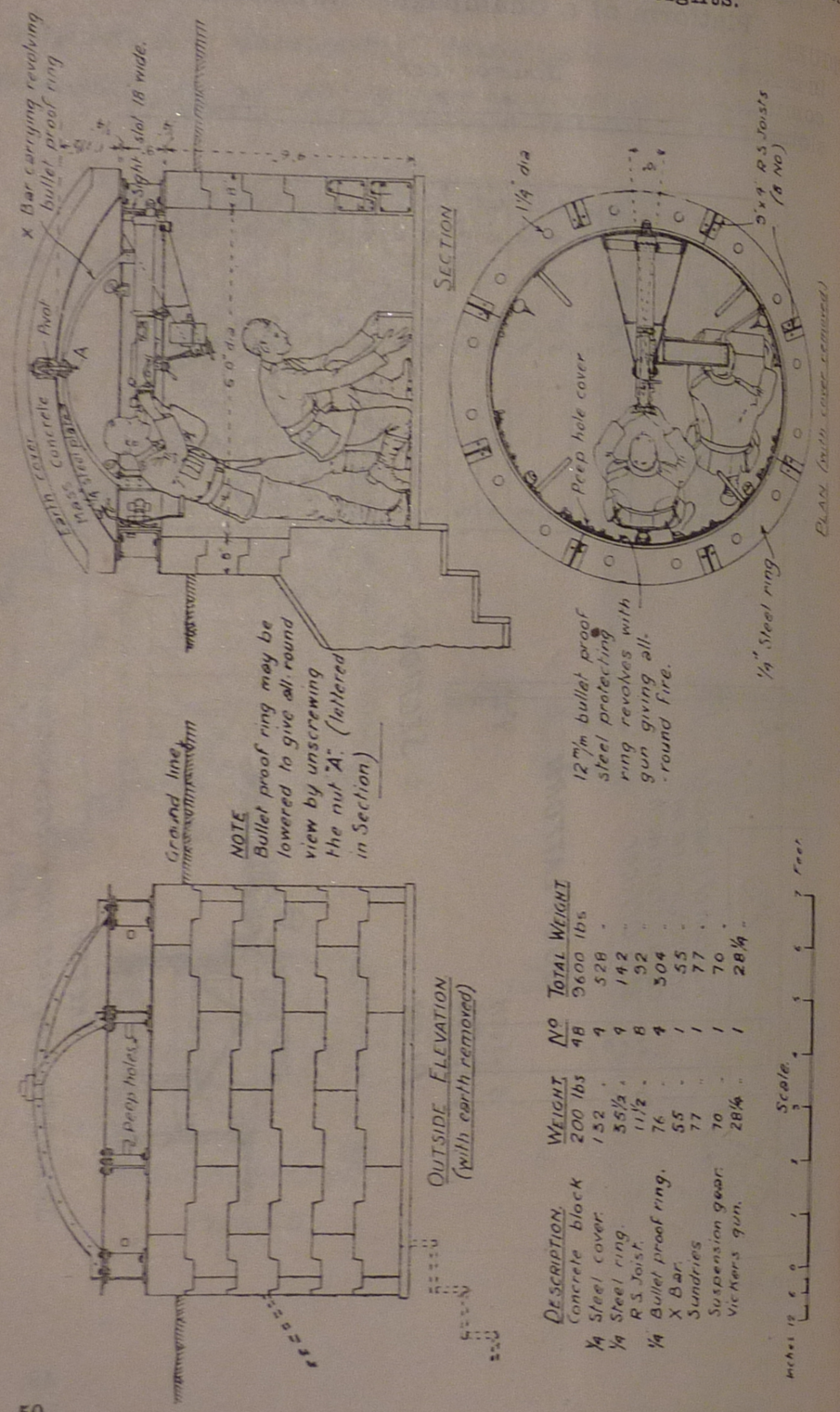




SKETCH
Showing Gun being fired from reverse position

Range-takers and instruments.

FIGURE 8.—The "Moir" Pill Box, shewing main details of construction, dimensions, and weights.



DESCRIPTION.	WEIGHT	No	TOTAL WEIGHT
Concrete block	200 lbs	48	9600 lbs
¼ Steel cover.	132 "	4	528 "
¼ Steel ring.	35½ "	4	142 "
R.S. Joist.	11½ "	8	92 "
¼ Bullet proof ring.	76 "	4	304 "
X Bar.	55 "	1	55 "
Sundries	77 "	1	77 "
Suspension gear	70 "	1	70 "
Vickers gun.	28¼ "	1	28¼ "

FIGURE 9.—A view shewing two "Moir" Pill Boxes concealed in a large bomb crater, with tunnelled entrances. A gallery communicates with a concrete dug-out situated in the slope of the interior of the crater.

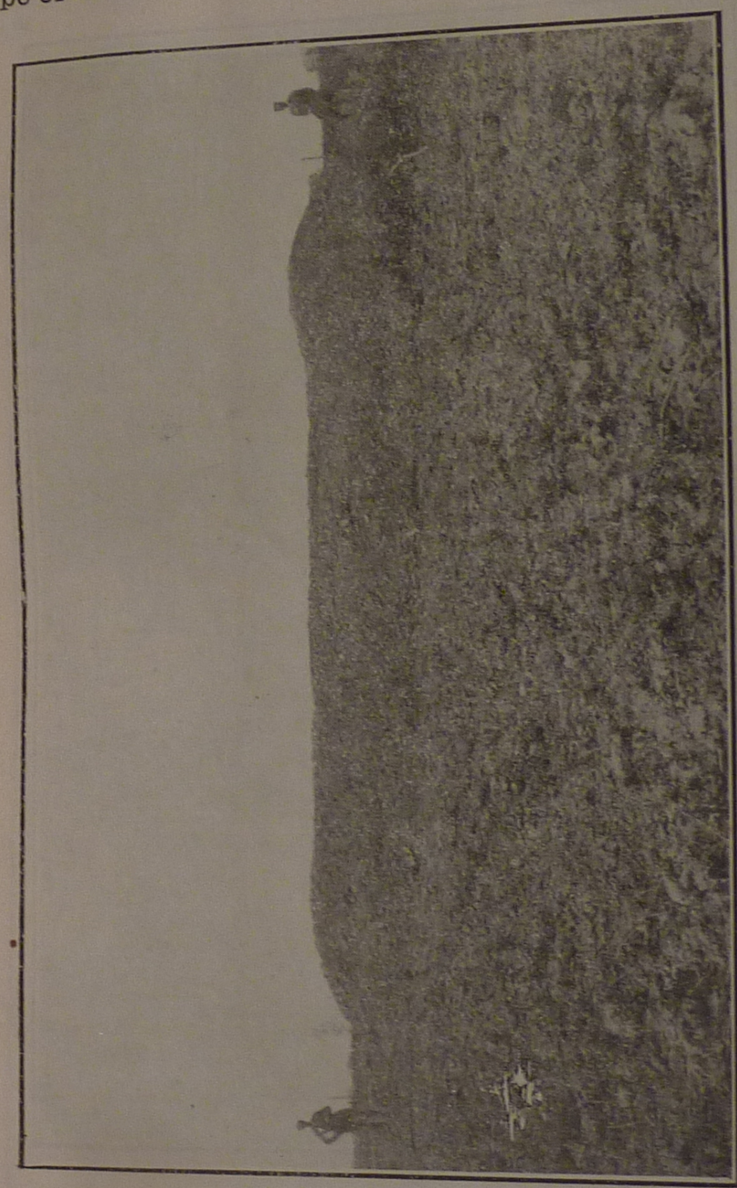


FIGURE 10.—A close view of the left hand Pill Box illustrated in Figure 9, shewing concealed loopholes.

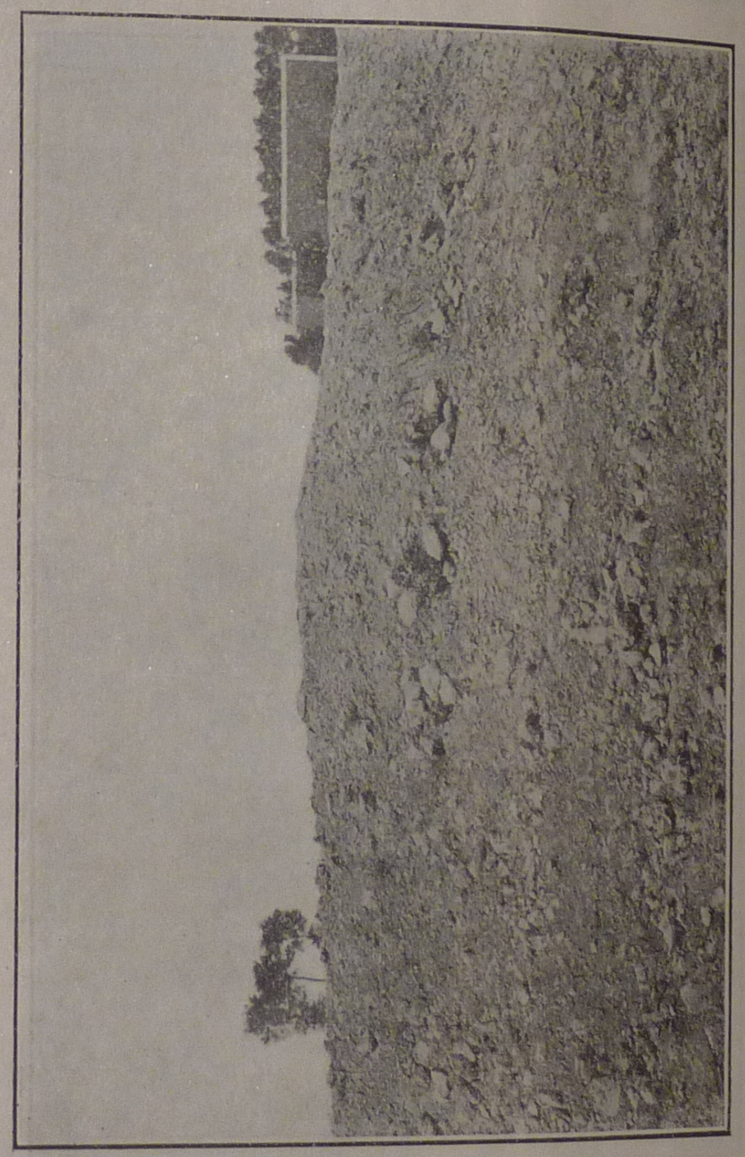


FIGURE 11.—A close view of a Moir Pill Box concealed in rear of a hedge, through which the machine gunner can both see and fire without any further preparation of the hedge.

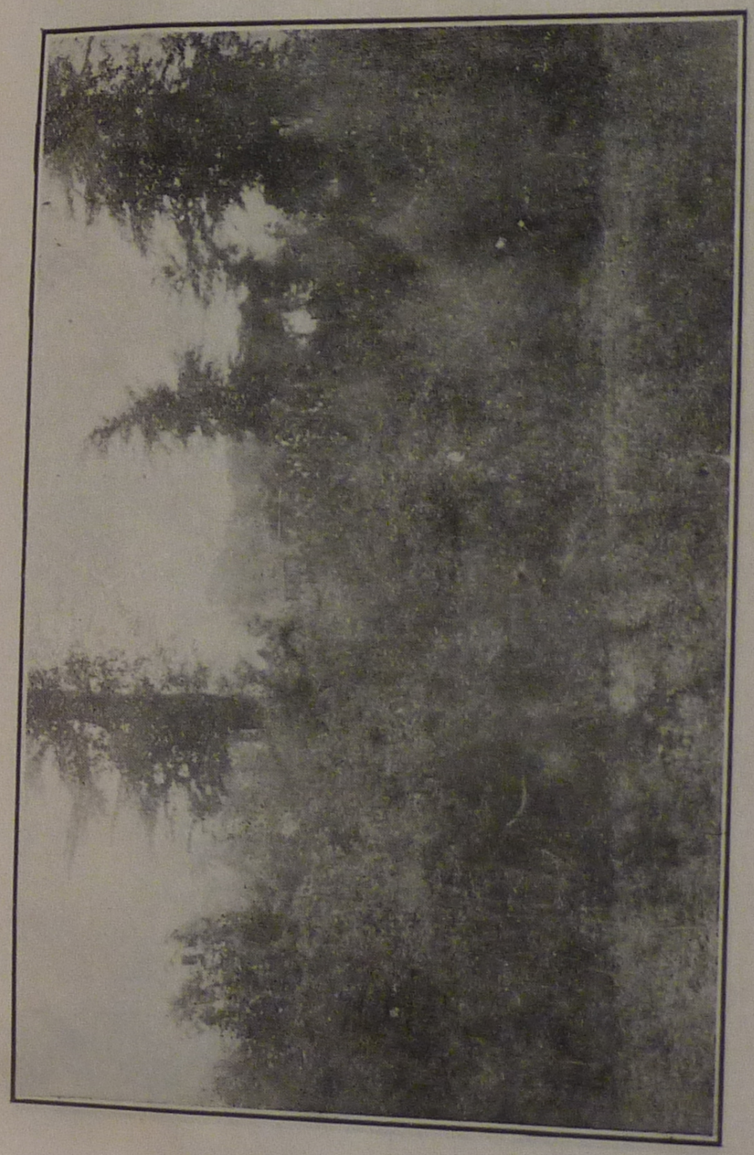


FIGURE 12.—A view taken from the rear of the Pill Box shewn in Figure 11. It is entirely concealed from aerial observation by a spreading elm tree above it. A false hedge has been continued over the Pill Box.

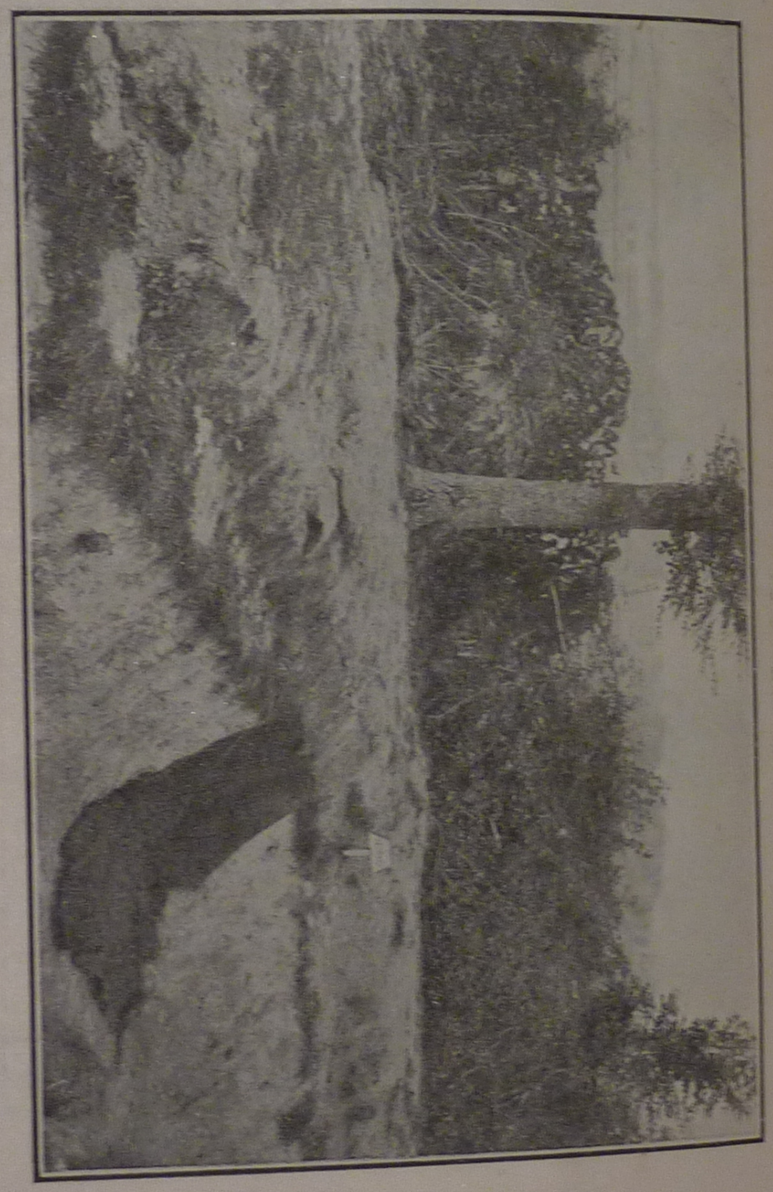
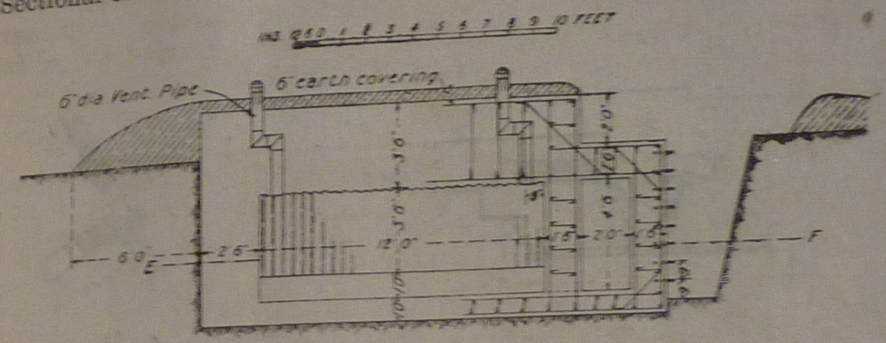


FIGURE 13.—Reinforced Concrete Shelter, with a Platform from which a Machine Gun can be fired from the roof.

Sectional elevations, and plan shewing main constructional details.

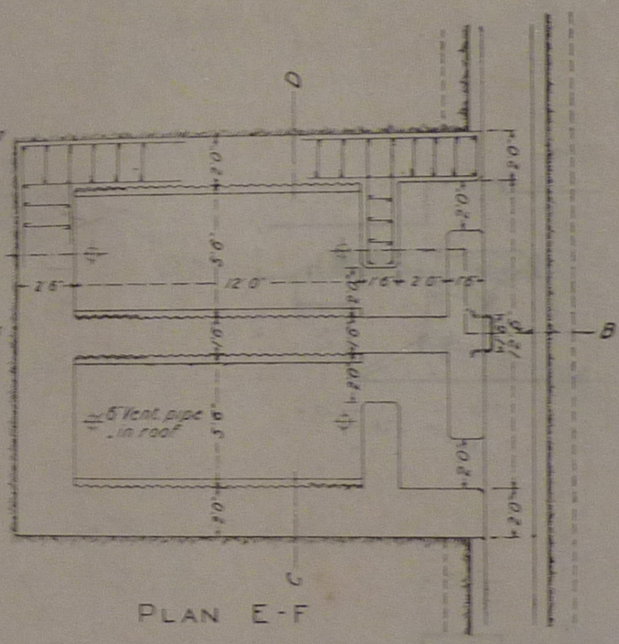


SECTION A-B

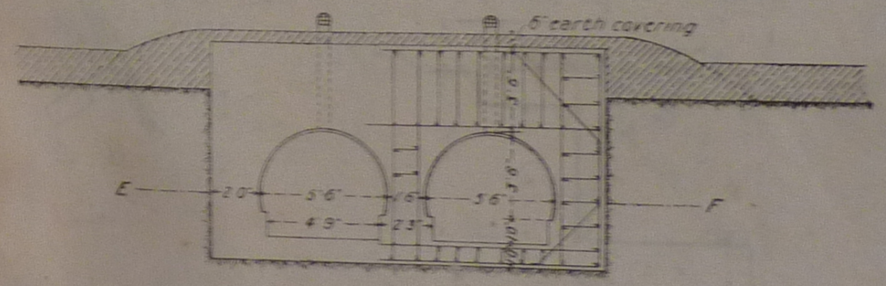
NOTE:
The platform over the Entrance enables a Vickers or Lewis Gun to be fired from the roof of the shelter.

If the Shelter cannot be so far below ground level as shown, the side walls should be carried down below the floor to prevent shells with delay-action fuzes penetrating and bursting under it.

Anti-gas arrangements must include plugs for the ventilators.

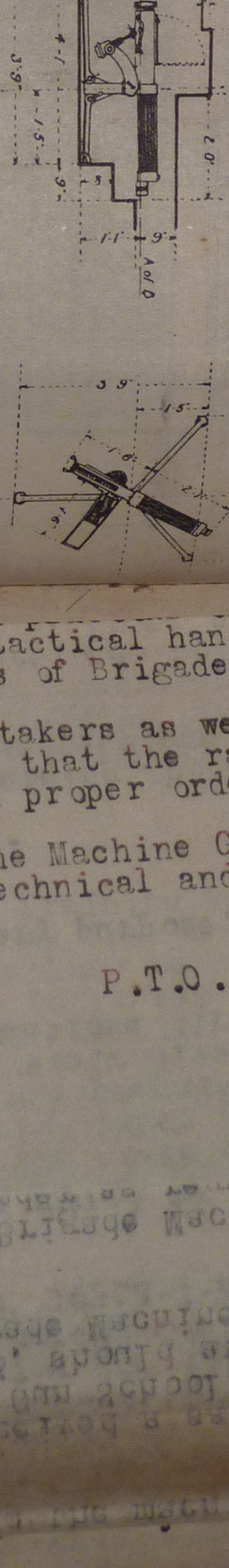


PLAN E-F



SECTION C-D

FIGURE 14.—Diagram shewing the minimum dimensions for Machine Gun Emplacements and Firing Platforms based on the dimensions of the Mark IV. Tripod.



of the Brigade, exemplifying the tactical handling of machine guns and the principles of Brigade control;

(c) to supervise the training of range-takers as well as their quarterly tests, and to see that the range-finding instruments are maintained in proper order.

He should keep in constant touch with the Machine Gun School to keep up to date with developments, both technical and tactical.

P.T.O.

range-takers and instruments."

Copy of a letter No. 18671-1-M.T.-1, dated the 11th March 1925, from the Chief of the General Staff, Army Headquarters, India, Delhi, to the Headquarters, Northern, Eastern, Western and Southern Commands, and Burma Independent District.

"Machine Gun Training.

As stated in Part I, paragraph 1 (b) of Training Memorandum (No. 15364-1-M. T.-1, dated 25th May 1924), and from the reports of the Commandant, Machine Gun School, it has long been thought that the standard of machine gun training in India was unduly low. This was confirmed by reports of a concentration of a number of machine gun platoons held at Abbottabad in September 1924. This concentration brought to light considerable weakness in various respects. The following instructions are therefore issued with a view to the attainment of a higher standard of training and of the necessary degree of uniformity in tactical methods.

2. Attention was drawn in this office No. 16279-1-M.T.-1 of the 1st April 1924, Part II, C(v) to the problems connected with the brigading of machine guns. In this office No. 17567-1-M.T-1, dated 28th July 1924, the appointment of a Brigade Machine Gun Officer in every brigade was ordered. His Excellency the Commander-in-Chief desires that in all cases this appointment shall be held by an officer of the rank of Major or senior Captain, preferably belonging to the Indian Army. It is desirable that he should not at the same time command the machine guns of his unit.

3. The officer appointed should have received a satisfactory report at a qualifying course at a Machine Gun School. Officers who qualified prior to the 1st January 1923, should attend a special refresher course for potential Brigade Machine Gun Officers as soon as possible.

4. During operations, the duties of the Brigade Machine Gun Officer will be to advise the Brigade Commander as regards the dispositions and tasks of machine guns. In the event of some or all of the machine gun platoons or troops being taken under Brigade control, he will be responsible for the preparation for Brigade orders of the paragraph dealing with their disposition and tasks. In this case he will issue instructions direct to the commanders of these machine guns.

Occasionally, for a definite and temporary purpose, he may be given command of a number of machine guns.

5. In peace training he will be available:-

(a) to assist unit commanders in the training, both technical and tactical, of their machine gun platoons or troops:

(b) under the Brigade Commander's instructions, to carry out exercises with the machine gun platoons or troops of the Brigade, exemplifying the tactical handling of machine guns and the principles of Brigade control;

(c) to supervise the training of range-takers as well as their quarterly tests, and to see that the range-finding instruments are maintained in proper order.

He should keep in constant touch with the Machine Gun School to keep up to date with developments, both technical and tactical.

P.T.O.

6. It is realised that the peace establishment of Indian Infantry battalions does not in all cases admit of the appointment of a whole-time British officer to command the machine gun platoon. At the same time His excellency the Commander-in-Chief desires that commanding officers shall appoint such as officer whenever possible. It must be borne in mind that the fire power of a machine gun platoon, if properly trained and handled, is equal to that of a company and that the fighting efficiency of a battalion is vastly increased by the appointment of a qualified British officer to this command.

The same applies in a somewhat lesser degree to the appointment of an Indian officer, and commanding officers should consider whether the efficiency of their command will not be improved by such an appointment.

7. Machine guns taken under Brigade control must always be accompanied by signallers provided by their unit. The minimum number for efficiency has been found to be one non-commissioned officer and five men.

8. The training of range-takers requires constant supervision In this connection an India Army Order will shortly issue detailing the method of conducting the quarterly tests of range-takers and instruments."

FANTRY VICKERS GUN PAMPHLET

(INDIA)

(PROVISIONAL)

1923.

GENERAL STAFF, INDIA.

SIMLA:

NTED AT THE GOVERNMENT MONOTYPE PRESS,

1923.

This pamphlet is issued as a provisional measure and has been prepared with a view to assisting the Vickers gun officers of British and Indian Infantry Battalions.

It contains extracts from those official publications which govern the organization and administration of Vickers gun platoons.

It is not to be quoted as the authority for the supply of equipment and stores.

The sections dealing with Pack gear and Drill are liable to such modifications as further experience may necessitate, and amendments thereto will be issued as the occasion demands.

CONTENTS.

	Pages.
SECTION I.—Pack Gear.—	
A.—Description and instructions for use	1
B.—Load tables	12
C.—Illustrations of loaded mules	15
SECTION II.—Drill and manœuvre.—	
A.—Drill	18
B.—Illustrative plates	25
(*i*) Key to plates	25
(*ii*) Vickers gun section in line	26
(*iii*) Vickers gun section in column of route	27
(*iv*) Vickers gun section moving under artillery fire	28
SECTION III.—Peace and War. Establishments of Vickers gun detachments of British and Indian Infantry Battalions.—	
A.—British Infantry	29
B.—Indian Infantry	29
SECTION IV.—Scales of equipment, etc.—	
A.—Reproduction in full of A. Is. I. and I. A. Os. containing scales of equipment and scales of spare parts, etc., of Vickers guns	30
B.—Reference numbers of other A. Is. I. and I. A. Os. containing information regarding Vickers guns	49
SECTION V.—Miscellaneous information	50

INFANTRY VICKERS GUN PAMPHLET (INDIA) (Provisional) 1923.

SECTION I.—Pack Gear.

A.—Description and instructions for use.

(1) Appendix II to A. I. I. No. 86 of 1923.

Details of Infantry pattern carrying equipment for a sub-section of 2 Vickers guns (consisting of 2 gun sets, 5 ammunition sets and 1 spare mule set).

Item number.	Detail.	Scale per					Remarks.
		Gun mule.	1st and 2nd ammunition mule of each gun.	5th ammunition mule of sub-section.	Spare mule of sub-section.	Total per sub-section of 2 guns.	
	P. S., G. S.—						
1	Bits, bridoon . .	1	1	1	1	8	
2	Breeching, Mark V .	1	1	1	1	8	
3	Collars, breast, Mark V	1	1	1	1	8	
4	Collars, head, Mark IV	1	1	1	1	8	
5	Cruppers, Mark V .	1	1	1	1	8	
6	Girths, Mark V . .	2	2	2	2	16	
7	Panels, Mark V . pairs	1	1	1	1	8	
8	Reins, bridoon . .	1	1	1	1	8	
9	Ropes, baggage . pairs	..	..	..	2	2	
10	Straps, girth, Mark II .	4	4	4	4	32	
	P. S., M. G., ·303-inch—						
11	Bands, belly . .	1	..	..	..	2	
12	Bands, belly straps, long. . . .	1	..	..	..	2	
13	Bands, belly straps, short. . . .	1	..	..	..	2	
14	Bands, belly, straps, supporting. . .	2	..	..	..	4	

(*I*) *Appendix II to A. I. I. No. 86 of 1923*—contd.

Details of Infantry pattern carrying equipment for a sub-section of 2 Vickers guns (consisting of 2 gun sets, 5 ammunition sets of 1 spare mule set)—contd.

Item number.	Detail.	Scale per					Remarks.
		Gun mule.	1st and 2nd ammunition mule of each gun.	5th ammunition mule of sub-section.	Spare mule of sub-section.	Total per sub-section of 2 guns.	
15	Bottle, water . .	1	½*	..	..	4	
16	Carrier, line gear, V. G. I. P.†‡ . . prs.	..	..	..	1	1	
17	Hangers, gun sling .	1	..	..	..	2	
18	Hangers, tripod sling .	1	..	..	..	2	
19	Racks, belt box, Mark II. I. P.— Near . . } prs. Off . . }	..	1	1	..	5	
20	Saddles, Mark III I. P. .	1	1	1	1	8	
21	Securer, tripod, I. P. .	1	..	..	..	2	
22	Straps, securing, entrenching tools . .	..	..	2¶	..	2	
23	Straps, top load . .	1§	1‖	1¶	1	8	

*1 carried on the 2nd ammunition mule per gun. Cans, water or borax water may be issued in lieu till stocks become available.

†Design under consideration.

‡Carry the following items per sub-section :—

8 sets of linegear each consisting of 1 pad roller, 1 roller, 2 picketing pegs, 1 nose bag, 1 horse brush, 1 curry comb, 1 (each) shackles fore and hind foot, 1 sponge and 1 heel rope. Also

3 forage nets.
2 pairs baggage ropes. } per sub-section.
1 hammer, peg, picketing.

§Secures the water box or bottle.

‖Secures the spare parts box on 1st ammunition mule and water box or bottle on 2nd ammunition mule.

¶Secures 2 picks, 2 helves and 2 shovels on frame.

(*II*) *Description and use of items common to all sets.*

1. Bits, bridoon.
2. Collars, head, Mark IV. or P.S.G.S., I.P. Collars head, Mark III.
3. Reins, bridoon.
4. Breeching, Mark V.
5. Collars, breast, Mark V.
6. Cruppers, Mark V.
7. Girths, Mark V.
8. Pannels, Mark V.
9. Straps, girth, Mark II.
10. Saddle, Mark III. I. P.
11. Straps, top load.

	Handbook ·303* V.G. page
1 Bits, bridoon	128
2 Collars, head, Mark IV	128
3 Reins, bridoon (*a*)	136
4 and 5 Breeching, Mark V and Collars, breast, Mark V.*	

* Handbook ·303 V. G., page 128, but note that the breeching and breast collar straps differ in the following respects :—

That for the breeching is a separate strap looped to the link on the pannel through its own leather dee ; that for the breast collar passes through the link and buckles back on itself.

	Handbook ·303″ V.G. Page.
6 Cruppers, Mark V	128
7 Girths, Mark V	129

Girthing up will be so regulated that the buckle on either side lies above the lower edge of the pannel, but, in the case of

(*a*) These will be replaced by P. G. S., I. P., Rein (I. L. C. 8761) as stocks are exhausted.

the gun mule, low enough to avoid interfering with the belly band supporting strap.

	Handbook ·303" V.G. Page.
8 Pannels, Mark V	129

Note that the "lay" on the pannel is the heavy strap stitched horizontally near the bottom edge of the pannel, to the ends of which the dees and hooks for the breeching and breast collar are fixed.

In the centre of the "lay" is an unstitched length of about 2 inches; this is the "slot in the lay" referred to later in connection with the belly band supporting strap.

	Handbook ·303" V.G.
9 Straps, girth, Mark II	129

These (two each side) are looped through their own leather dees through the slots in the wooden side bars of the tree, smooth surface of strap outwards.

10. Saddle, Mark III. I.P.
11. Straps, top load.

The P. S. M. G. saddle, Mark III. I. P. consists of a rectangular metal frame built up on two metal arches (the smaller nearest head of mule) the feet of which are attached to wooden side bars which engage in the pockets in the pannels. Near the feet of the arches are metal hooks, two each side, to support the gun and tripod hangers or the rack belt box.

The frame is designed to carry any of the following top loads:—

Bottle, water.
Box, spare parts.
Box, water.

It is fitted with dees on either side for the strap top load which strap is part of the saddle as issued. This strap is threaded through the dees so as to pass under the frame and in such a way that buckling up will be done on the near side with a downward pull. At the front end of the near side a metal "seating block" is provided to allow of the assembling of the tripod securer on any saddle.

The attachment of the feet of the arches to the side bars is rigid but some issues are the "English pattern tree adjustable" modified for India, with moveable trees (I. L. C. 11588).

(III) Gun and Tripod set.

(a) Description and use.

1. Securer, tripod.
2. Bands, belly.
3. Bands, belly straps, long.
4. Bands, belly straps, short.
5. Bands, belly straps, supporting.
6. Hangers, gun sling.
7. Hangers, tripod sling.

1. Securer, tripod.

The attachment which is metal consists of a vertical leather-faced column at the bottom of which is fitted a horizontal arm: near the base of the column above the arm is a hook and at the end of the arm a pair of flat jaws. The face of the column is turned slightly forward; a securing strap is rivetted to the back of the column.

The securer can be assembled on any frame; this is done by engaging the hook at the base of the column over the edge of the frame a little in rear of the seating block. The attachment is then tapped forward as far as it will go: this engages the jaws on the "arm" with the front curved water bottle bearing,

and brings the attachment to a solid bearing over its seating block.

2, 3, 4, and 5 Belly band set.....Hand book 303, V. G., page 134.

Normally one strap long and one strap short form a pair in a belly band set, but it is often advisable to split the pairs and use two long straps on a big-girthed mule and two short on a small one. With an average set of mules correct length can be got in every case by judicious pairing of the set of straps.

When a normal pair is used, the short strap is used on the off (gun) side and is looped by its own dee on to the bar of the hanger in front of the metal dee, in such a way that its leather dee is at the top edge of the bar, the strap pointing up and showing its unprepared surface ; the long strap is similarly attached on the near side.

The belly band supporting strap is inserted from below in the slot in the lay of the pannel, passed through its own leather dee and tightened up in such a manner that this dee lies above the lay and the end of the strap points upwards.

One supporting strap each side is passed through the aperture in the leather flap of the belly band, and buckled, using the "longest" hole in nearly every case ; the end of strap is then passed through the keeper ; these straps are always connected.

6 and 7, Hanger, gun sling, and Hanger, tripod sling.

These consist of wooden bearing bars to which are rivetted felt lined leather slings, fitted with metal dees for hanging on the hooks of the frame, the lower engaging the same hooks after being passed under, round, and over the load. The dees termed "upper" are those on the short portions of the slings.

The gun hanger has a metal dee on the lower edge of the centre of its bearing bar, and its dee securing straps are of a buckled pattern.

The tripod hanger has no dee on its bearing bar and its dee securing straps are of the quick release type.

Some units will receive an old pattern hanger modified in conformity with the above description, but not precisely identical in every detail ; securing straps may be all of the buckled type, for example ; in practice the differences are immaterial.

(*b*) Loading.

1. *Gun.*

The upper dees having been placed on hooks on the off side of the tree, the gun is placed on the hanger with the rear cross-piece towards head of the mule, the top of the gun uppermost, but tilted slightly inwards, the front sling round the feed block. The lower (and longer) ends of the slings are brought over the gun, the dees are engaged on the tree hooks and the securing straps fastened.

The belly band strap is passed over the barrel casing, down through the metal dee on the bearing bar and buckled to the belly band.

2. Tripod.

The tripod hanger is attached and secured similarly to the gun hanger ; the tripod is placed in the slings with shoes to the rear and the cross-head uppermost ; the socket is tilted inwards and placed so that the forward sling bears close round it.

The cross-head arm will now bear against the column of the tripod securer, and the traversing clamp can be adjusted to get a snug bearing against the leather face.

The plain end of the securing strap on the column is passed forward and then outwards round the socket under the direc-

tion dial (avoiding clamping screws, etc.), and then backwards to meet the buckle end between the wings of the cross-head arm, where buckling up is done with a downward and forward pull.

When tightly buckled, the tripod is held rigidly in position and all tendency to slide forwards and swing outwards is completely overcome.

The belly band strap is brought up over the legs of the tripod, given one forward turn round the legs, and buckled to the belly band. The belly band, where it passes under the mule, must lie on the girth and not on hide, and buckling up of the belly band straps must be so regulated that the buckles are above the lower edge of the pannel each side, and that there is no tension on the belly band securing straps.

3. The 1st bottle, water, lies in its curved seating on the frame, handle uppermost, nozzel end to the front, and is secured by the top load strap, the buckle end passing through the handle, and meeting plain end on the near side.

4. The condenser bag, with tube coiled inside, is inserted between the gun and the pannel and secured by loosely buckling its own brace to the front arch.

5. The spare parts case is placed between the gun and the pannel, resting on the edge of the condenser bag, the lid strap upwards, the top of the case to rear and close against the inner edge of the rear sling: its carrying strap is passed through this sling, and buckled tightly round the barrel casing.

The carrying strap can be so adjusted that the buckling up is done with a downward pull on the outer side of the barrel casing.

6. The belt box carrier lies horizontally along the off side of the water bottle with the hooks to the rear and its lower side bar immediately above the edge of the frame. It is

held in position by the top load strap being passed under the lower side bar referred to above, up, and over the upper side bar.

7. The feed in nose bag is attached by its own brace to the near side of the rear arch, and tucked between the slings on the inner side of the legs of the tripod.

(IV) *Ammunition set.*

(*a*) Description and use of items peculiar to this set.

1. Racks, off side.
2. Racks, near side.

1 and 2 racks, off and near side.

The new pattern rack is similar to the old I. P. racks, belt box, but is modified as under :—

Designed to carry metal belt boxes only.

Lightened to 13 lbs. each.

Leather on wooden battens at back is omitted.

The steadying strap dees are set on at an angle which gives the straps a forward lead to the girth instead of straight down.

It is fitted internally with leather to reduce noise to a minimum.

The treble thickness of leather along the floor of the rack at the back (or inner side) is designed to give a good fit, which would not be obtained otherwise, on account of the overhang of the lid bearing on the outer edge.

The off side rack is that with the buckled steadying strap, and the near side rack that with the plain strap.

The hooks on the tree and the rings on the racks, in the new pattern gear, are so designed that, though the latter can not jerk off, the rack, with or without filled belts in it, can be

lifted in its normal hanging position and hooked on easily (or removed) without any tilting up and out of the lower portion.

(*b*) Loading.

1. 1st ammunition set of each gun.

(*i*) *Racks.*

The two racks are hung on the hooks of the tree by their own metal dees, the weight being held up until both the loads are hooked.

The buckled steadying strap from the off side rack is passed over the girth and buckled sufficiently tightly to control the load.

(*ii*) *Spare parts box.*

The spare parts box, lid straps (*a*) on near side, is fitted into its seating on the frame. It is secured by the top load securing strap (which passes outside the spare barrel).

Where the wooden box is used, substitute "the catch of lid on near side" and add "the top load securing strap is passed through the leather handles to lie flat on the box."

(*iii*) *Spare barrel.*

The cleaning rod is inserted and fastened by its securing strap on the spare barrel case, through its handle.

The spare barrel is then placed so as to lie along the near side edge of the frame, the muzzle to the rear, and attached by its own two fixed securing straps to the frame, in such a

Notes.—(*a*) This refers to the leather S. P. Box which will in future be issued as the wooden boxes become unserviceable.

(*b*) With the wooden S. P. Box the spare barrel case securing straps should be equidistant from the ends of the frame.

way that they each lie just forward of the corresponding lid straps (*b*) of the S. P. box; they are given an extra turn round the spare barrel.

(*iv*) *Feed in bag.*

Attached to the centre of front arch by its own brace, and laid along the top of the belt boxes on the off side.

2. 2nd ammunition set of each gun.

(*i*) Racks, as for the 1st ammunition set.

(*ii*) Feed, " " "

(*iii*) 2nd water bottle on the frame as in the gun set.

3. 5th ammunition set of sub-section.

(*i*) *Racks. As for 1st ammunition set.*

(*ii*) *Entrenching tools. (2 shovels, 2 picks and 2 helves.)*

Place two picks longitudinally on the frame side by side in centre, the concave curve uppermost. One helve on either side, the thick end forward: on top two shovels one above the other, blades to rear, faces uppermost.

The forward end of load must be far enough back to clear the mule's neck when its head is thrown up.

The top load strap is given a turn round the helve and frame on either side then over the load with the usual near side buckling.

At the forward end of the frame, the buckle end of one entrenching tool strap is given a turn round the near side pick and helve under frame and over load from the off side, and buckled on the near side with a downward pull.

At the rear end of the frame the same procedure with the other entrenching tool strap, except that the turn round the pick and helve is taken on the off side.

(*iii*) *Feed.*

Placed centrally on the top of load and secured by its own brace passing down under the frame from the off side and being tied with a looped half hitch on itself.

4. Spare mule set of sub-section.

(*i*) *Carriers line gear V. G.*

One off, one near side, for 4 sets line gear each.

(*ii*) *Feed in bag.*

Attached to the centre of the front arch by its own brace, and carried as a top load.

Note.—Design of line gear carriers will enable all heavy and small items to be packed loose in them. Forage nets, line gear bags (the 2nd bag, nose, small, of the 2 issued per mule) being carried as a top load also.

B. Load Tables.

(*i*) *Gun Mule.*

Near side.	lbs.	Centre.	lbs.	Off side.	lbs.
Tripod (with dials).	52	Water bottle, filled.	19	Gun (war manufacture), with water.	43
Hanger, tripod sling.	9	Saddlery common to all mules.	43	Hanger, gun sling.	7
Tripod, securer	2			Spare parts case	8
Nose bag, with feed.	7	Saddlery peculiar to gun mule.	2	Condenser, set .	3
		Total .	64	Carrier, belt box	7
Total .	70	Total, gun mule	202	Total .	68

(*ii*) *1st Ammunition mule.*

Near side.	lbs.	Centre.	lbs.	Off side.	lbs.
4 filled belts in metal boxes.	88	Spare parts box (leather) filled.	12	4 filled belts in metal boxes.	88
Rack, belt box, Mark II.	13	Saddlery .	43	Rack belt box, Mark II.	13
Spare barrel and cleaning rod in case.	6			Nose bag with feed.	7
Total .	107	Total .	55	Total .	108
		Total, 1st ammunition mule.	270		

(*iii*) *2nd Ammunition mule.*

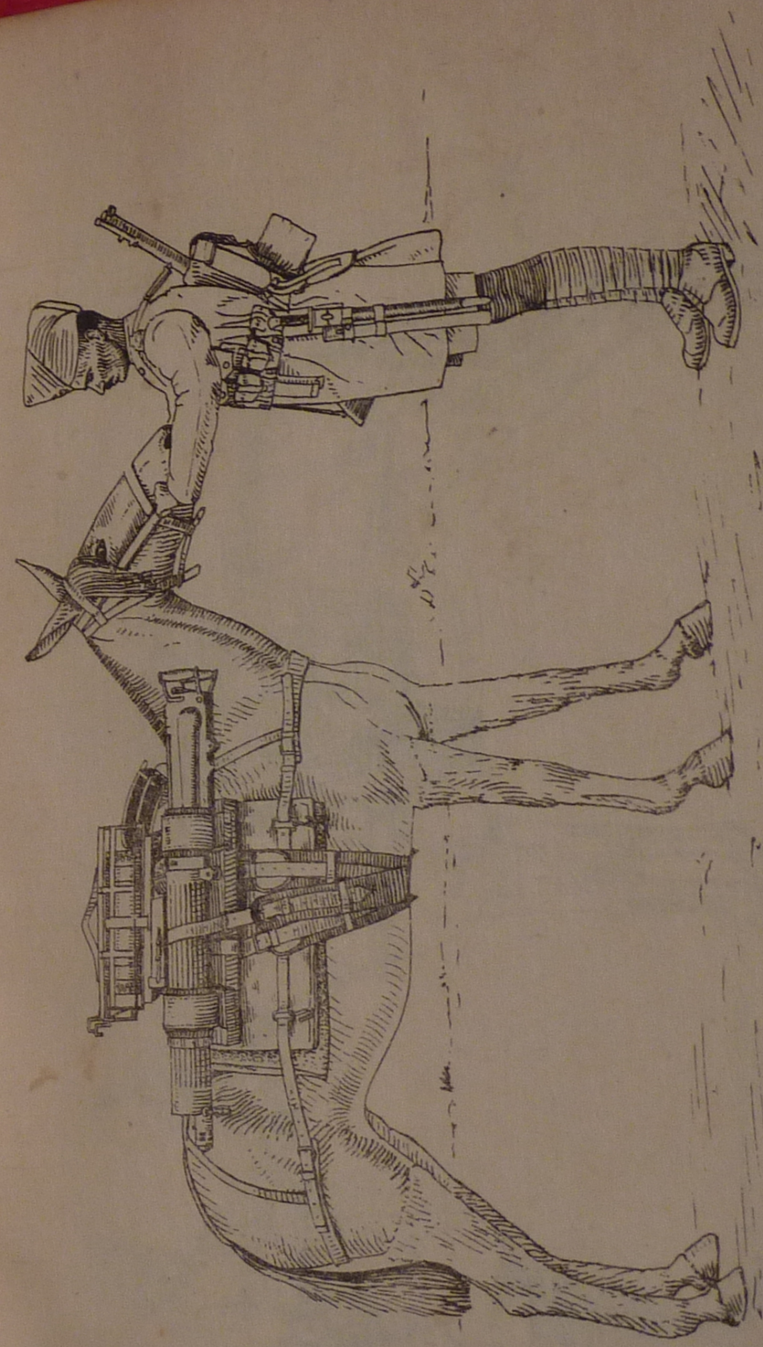
Near side.	lbs.	Centre.	lbs.	Off side.	lbs.
Belts and rack	101	Water bottle filled.	19	Belts rack and feed.	108
		Saddlery .	43		
Total .	101	Total .	62	Total .	108
		Total, 2nd ammunition mule.	271		

(iv) 5th Ammunition mule of sub-section.

Near side.	lbs.	Centre.	lbs.	Off side.	lbs.
Belts and rack	101	2 picks, 2 helves 2 shovels and straps.	22	Belts and rack	101
		Nose bag with feed.	7		
		Saddlery .	43		
Total .	101	Total .	72	Total .	101
		Total 5th ammunition mule of sub-section.	274		

(v) Spare mule of sub-section.

Near side.	lbs.	Centre.	lbs.	Off side.	lbs.
4 sets line gear	64	8 nose bags, 3 forage nets, 2 prs. baggage ropes, 1 hammer peg picketing.	20	4 sets line gear,	64
1 carrier line gear V. G.	11			1 carrier line gear V. G.	11
		Nose bag with feed.	7		
		Saddlery .	43		
Total .	75	Total .	70	Total .	75
		Total spare mule of sub-section.	220		



SDO 3584. May 1923

5th. Amunition mule of sub-section (near side)

S.D.O 3586. May 1923.

SECTION II.—DRILL.

I—

1. The Drill is based on Infantry Training 1922, Volume 1, and the two should be read together.

2. Section Drill only is dealt with : when a British Battalion has its two sections on parade together, procedure by O. C., V. G. Platoon will be similar to that of a Company Commander.

3. Except where special detail is given, all movements will be those shown in Infantry Training, and words of command will be identical, except that "section" will be substituted for "platoon," and "gun" for "section" etc.

4. The main reasons for any divergence from ordinary Infantry Drill are two :—

(*a*) Organisation of section in two sub-sections.
(*b*) Inclusion of mules within formations.

(*a*) Example :—

I. T. Volume I, Section 93.
This movement must be done in the first instance by subsections : if it is desired to obtain the deployment equivalent to that shown in Section 93, guns can subsequently be deployed from the subsection formation.

(*b*) Example :—

I. T. Volume I, Section 46, paragraph 4.
A Machine Gun unit having formed fours and moved to a flank, will have its mules in rear, *vide* plate II : consequently, on the order "reform line. Left (or right) turn," the mules will have to be lead by the shortest route and wheeled into their position when men are in line, *vide* plate I.

II—

Minor points of divergence from Infantry Training.

1. Carrying of rifles.

Rifles will be carried as in I. T. except when handling the gun and gear, when they will be slung.

2. Position of mules.

(*a*) *Vide* I. T. when legislated for therein.

(*b*) Immediately in rear of own section, subsection or gun team according to nature of order given, normally in file when men in fours; in single file when men in file: but, when section formed up in line, mules as per plate I.

3. Mules turning about.

(*a*) At the halt; mule turned *right* about on his haunches.

(*b*) On the move: mule wheeled *right* about and back on to old alignment.

4. Forming up.

(*a*) The No. 1 of the day will always fall in as right hand man of his team, and other numbers in sequence on his left; one team of a subsection forming the front rank, and the other the rear rank.

(*b*) Positions of Subsection Commanders, I. O., etc., as in plate I.

5. Halting.

(*a*) When section is halted as part of battalion, or etc., as in I. T., mules being pulled up short.

(*b*) When working independently, and at all times when practicable, order is given "At four paces....halt" executive word being less sharply given than normally, (and as left foot comes to ground.)

On executive word, drivers commence gradually checking mules; men lead on four paces and halt, by which time mules are fully pulled up.

III.—Movements peculiar to Machine Gun Units.

1. From line.

(*i*) Advancing in column of guns.

Section Commander orders:—

Advance by guns from the right (left) No. 1 (or etc.) gun leading. Form-fours. Right.

No. 1 Gun Commander will give "No. 1 gun left wheel-quick-march."

No. 1 Gun team leads off followed by its mules. Remaining guns in succession, on word of their commanders.

2. From fours, as a section on the move.

(*i*) Forming subsections.

Section Commander orders.

"Form subsections."

Leading subsection men lead on.

Rear subsection men step short.

Leading subsection mules disengage and close up on their subsection. When these are clear, rear subsection men resume normal rate of march followed by their mules.

(*ii*) Forming gun detachments.

Section Commander orders "form gun detachments."

Similar procedure.

3. From subsections in fours:—

(*i*) Forming gun detachments.

Section Commander orders "form gun detachments."

II—

Similar procedure.

(*ii*) Forming section.

Section Commander orders "form section."

Men of rear subsection disengage. Leading teams regulate pace until rear team is closed up: then step out, mules resuming position in rear.

4. From gun detachments.

(*i*) Deploying into artillery formation see diagram III.

(*ii*) Forming subsection or section.

Section Commander orders

"Form Subsection."

"Form Section."

as in 3 (*ii*) above.

ACTION FROM PACK.

"PREPARE FOR ACTION."

Near side.	*Off side.*
Nos. 1 & 5 will place themselves on near side of the gun mule.	Nos. 2 & 6 will place themselves on off side of the gun mule.
No. 1 nearest head of mule. No. 3.	No. 2 nearest head of mule No. 4.

To 1st ammunition mule.

No. 7 will be available for ground scout and other duties.

Notes :—

A.—When gun detachments are formed, men will be in file: should it not be desired to decrease frontage the caution "in fours" will be prefixed, in which case men will close up on the move.

B.—When gun detachments are moving separated one Machine Gunner of each team will move in rear of its last mule.

C.—Disengagement by men or mules will be to the right.

Exception.—Forming subsection or section from "Gun detachments" after an original move to the left in fours, 2nd and 4th teams in order o[illegible] march will disengage to left.

"ACTION."

No. 5 swings feed clear of saddle and releases belly band strap.	No. 6 releases belly band strap.
No. 1 undoes tripod securing strap.	
Nos. 1 and 5.	Nos. 2 and 6.

Undo sling securing straps and ease up:—

Tripod and open slings	Gun and open slings.

Note.—Each number deals with the sling nearest him.

No. 1.	No. 2.
Removes tripod.	Removes gun, spare parts case coming away on barrel casing, No. 6 releases condenser bag, and hands to No. 3.

No. 3.	No. 4.

Take from racks the belt boxes 2nd and 4th from front of 1st ammunition mule, No. 3 receives the condenser bag and tube from No. 6.

In the event of the belt box carrier being ordered up No. 5 will undo top load strap and No. 6 remove the carrier and hand to No. 3.

No. 3 will carry up one of the belt boxes in it.

No. 5.	No. 6.

Loop up slings and hooks and secure straps.

No. 5 places feed through rear sling, fastens top load securing strap, and buckles tripod securer strap loosely to frame.	

23

No. 5. | No. 6.

Fasten ammunition rack stays.

No. 5 readjusts feed.

From this point the gun team will come into action as laid down in Machine Gun Training.

The further supply of ammunition, water, spare parts box etc., being handled as the situation demands.

"ON PACK" (from action).

["*Out of action*" vide *M. G. T., 1921.*].

"On Pack."

No. 5. | No. 6.

Undoes

Tripod slings and ensures feed is clear of saddle. | Gun slings.

No. 1. | No. 2.

Places

Tripod on slings. | Gun on slings.

The four nos. loop up and secure their slings.

No. 1 fastens tripod securer strap while | No. 2 puts on condenser set and S. P. case while

No. 5. | No. 6.

Fasten belly band straps.

No. 5 readjusts feed. | No. 2 passes strap of S. P. case through sling:

No. 6 receives it and straps up while No. 2 fastens condenser.

No. 5 places water bottle on frame. | No. 6 adjusts belt box carrier and passes top load strap to No. 5.

No. 5 straps up.

No. 3. | No. 4.

Replace belt boxes; fasten stays.

No. 3 fastens S. P. box. | No. 4 readjusts feed.

When further belt boxes and items of gear have been in use they will be repacked under orders of gun commander.

Laying out of gear for loading.

The loads will be laid out as for mules in single file at one mule-length distance, in correct order, gun mule to fronts.

Interval between near and off side loads will be 3 yards.

Interval between gun sets (centre to centre) 7 yards.

The whole will be dressed by the right and covered front to rear.

The mules, ready saddled, will be lead between the load, from the rear into their positions, and loading carried out in the normal way; Nos. 5 and 6, on completion of their duties with the gun mule, assisting Nos. 3 and 4 to complete loading of ammunition (and spare) mules.

25—28

II—

MACHINE GUN DRILL

Key to Plates

= *Officer*

= *Serjeant*

I.O. = *Indian Officer*

I.H. = *Indian Havildar*

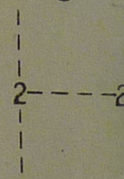
= *Gun Commander*

1.2.3.4.*Etc.*= *Actual Gun Numbers*

= *Gun Mule*

= *Ammunition Mule*

= *Spare Mule*

 *Paces. (Distance or Interval)*

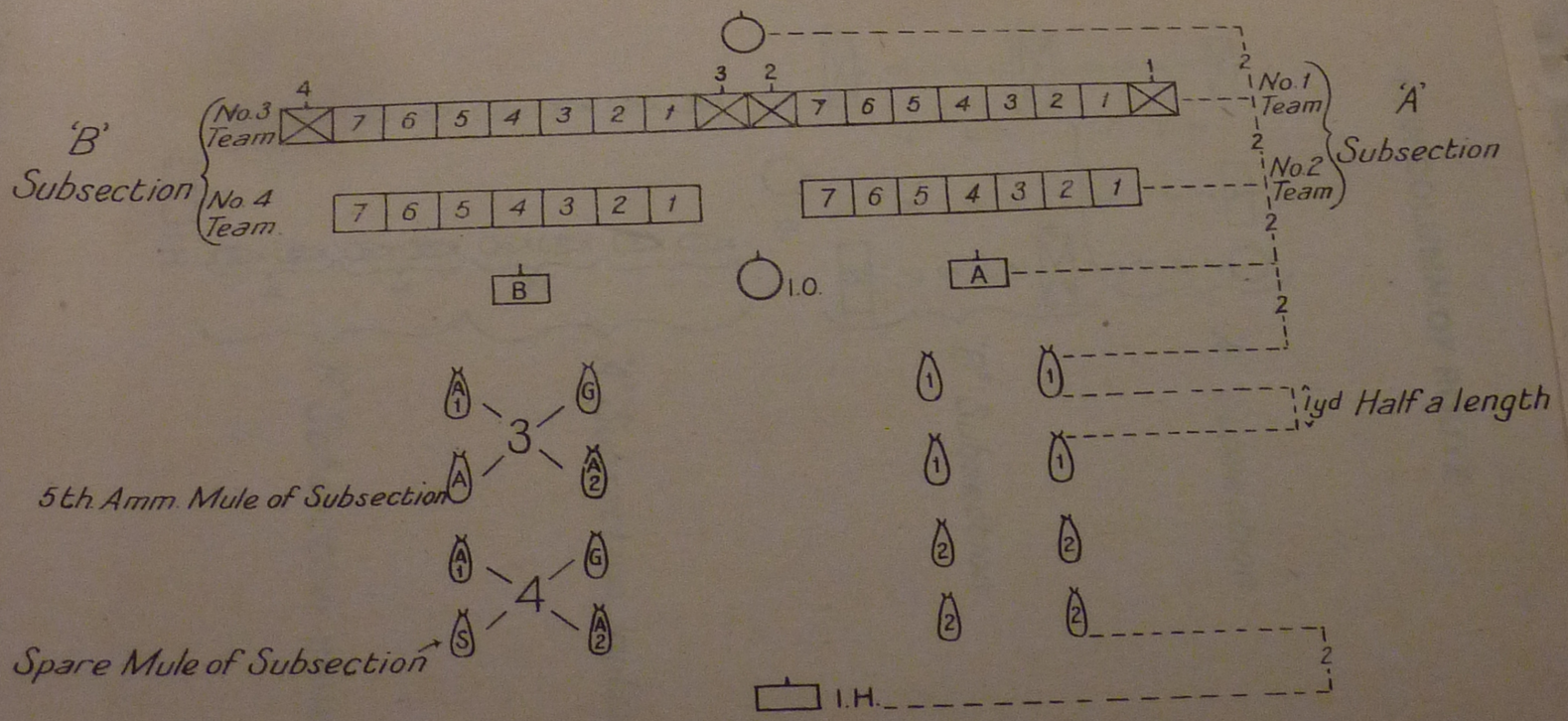
A = *'A' Subsection*

B = *'B' Subsection*

O. 3580. May 1923.

A MACHINE GUN SECTION

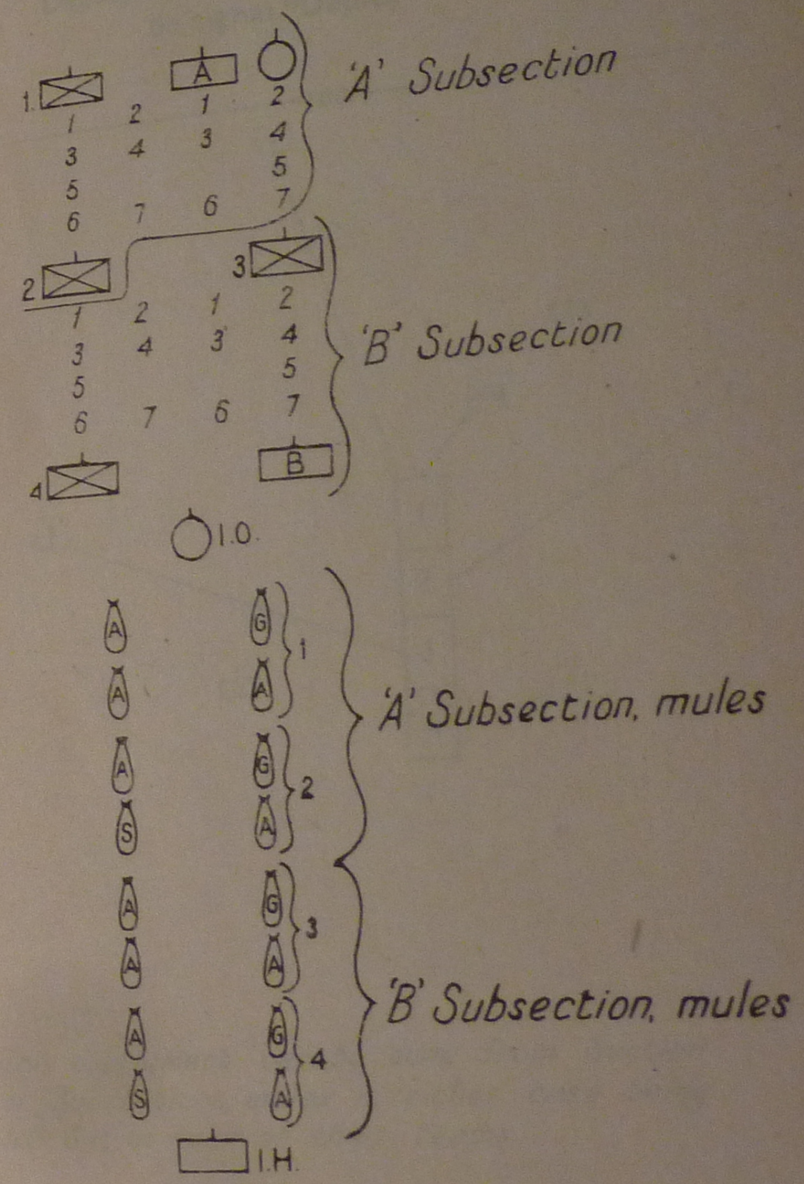
(i) In Line



S.D.O. 3581. May 1923.

II—

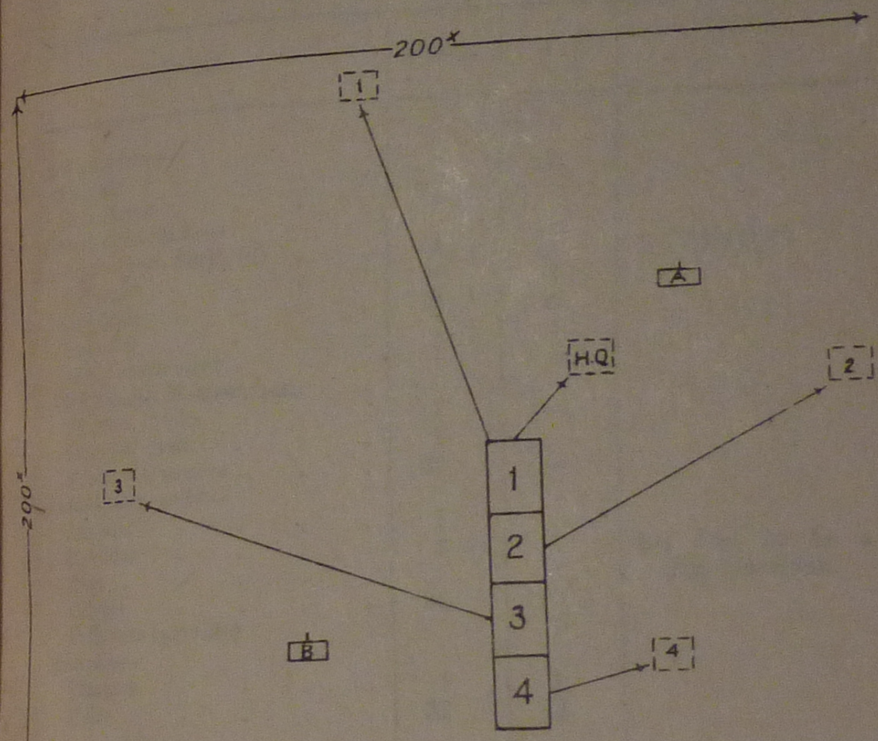
(ii) IN COLUMN OF ROUTE



II—

(iii) SUITABLE FORMATION for V. G. SECTION MOVING UNDER ARTILLERY FIRE

Deploying from "Column of Guns" on signal "Deploy"



This deployment can be done from Section or Subsections, mules in either case being led out in rear of their teams.

II—

SECTION III.—ESTABLISHMENTS.

(a) *British Infantry.*

Detail.	Peace.	War.	
British officers—			
Captain	1	1	
Subalterns	2	..	
British other ranks—			
Armourer S. Serjt. (a)	1	..	(a) Attached.
Serjeants	4	2	
Corporals	6	4	
Orderlies	..	2	
Asst. to armourer	1	..	
Private (Q. M. storeman)	1	..	
Privates, Cooks	1	..	
Privates, Clerk	1	..	
Machine Gunners	62	28	
Indian other ranks—			
Jemadar	1	..	
Havildar	2 (a)	1	(a) One to be a Pay Havildar.
Naik	1	1	
Drivers	36	16	
Followers (private)	..	1	
Animals.—			
Chargers	1	1	
Mules	32	16	

(b) *Indian Infantry.*

British officers	..	1	
Indian officer	..	1	
Havildars	2	2	
Naiks	4	2	
Sepoys	28	30 (a)	(a) Includes 2 Lance Naiks.
Drivers	17	17	
Orderlies	..	2	
Followers (private)	..	1	
Animals—			
Chargers	..	1	
Mules	16	16	

Note.—The Peace establishments of British Infantry are contained in A. I. I. No. 80 of 1921 and of Indian Infantry in A. I. I. No. 294 of 1921.

The War establishments of both British and Indian Infantry are contained in Vol. I of War Establishments, India, 1923.

30

SECTION IV.-A.

REPRODUCTION IN FULL OF A. I's. I. AND I. A. O.'S CONTAINING SCALES OF EQUIPMENT AND SCALES OF SPARE PARTS, ETC., OF VICKERS GUNS.

(*i*) *A. I. I. No. 522 of 1922.*

2. *Provisional scale of materials for the upkeep of Vickers gun equipment.*

The above A. I. I. is not reproduced.

Appendix "A" of this A. I. I. has been cancelled by A. I. I. No. 361 (*vide* page 46 of this pampblet).

Appendix "C" of this A. I. I. has been cancelled by A. I. I. No. 297 (*vide* page 43 of this pamphlet).

(*ii*) *A. I. I. No. 865 of 1922.*

865. Luminous Sights for Vickers Machine Guns.

It has been decided that luminous sights for Vickers machine guns will be issued on the following scale :—

	Scale.		
		Peace.	War.
British cavalry regiment	sets	2	1 per gun.
Indian cavalry regiment	,,	2	1 per gun.
British infantry battalion	,,	2	1 per gun.
Indian infantry battalion	,,	2	1 per gun.
Machine gun school	,,	12	*Nil.*

2. The number of sets required to complete to war scale will be held under arrangements to be made by the Quarter-master General in India.

3. Action should be taken to adjust the equipment in possession to this scale.

(*iii*) *A. I. I. No. 144 of 1923.*

144. Spare parts for Vickers guns.

With reference to Army Instruction (India) No. 473 of 1922 a provisional scale of spare parts for Vickers guns in India is shown in the Appendix to this Instruction. Indents will be submitted.

2. Army Instruction (India) No. 225 of 1919 is hereby cancelled.

II—

APPENDIX TO ARMY INSTRUCTION (INDIA) No. 1 OF 1923.

Scale of spare parts boxes for Vickers machine guns.

The following scale of spare parts boxes, cases and wall and their contents, will supersede that laid down in Ar Instruction (India) No. 225 of 1919 :—

Boxes, spare parts and tools, filled—1 per gun.

Cases, spare parts box, filled—1 per gun.

Wallets case spare parts box, filled—1 per gun.

Detail.	Scale per sub-section.		Total per sub-section.	Remarks.
	1st box.	2nd box.		
Contents of spare parts box.				
Blocks, jamming, with screw handle, Mk. IV tripod mounting.	1(*a*)	..	1 (*a*)	
Blocks, feed	1	1	2	
Boxes, tin, for small parts	2	2	4	
Bushes, axis, side levers	1	1	2	
Collars, roller	1	1	2	
Corks for plugs	2	2	4	
Cups, muzzle attachment	2	2	4	
Discs muzzle attachment	5	5	10	
Eyelets, long	½ oz.	..	½ oz.	
Fusees with chains	1	1	2	
Gauze wire pieces	2	2	4	
Gibs	1	..	1	
Glands, packing	1	1	2	
Hammer, machine gun	1	..	1	
Levers, extractor, left	1	..	1	
Levers, extractor, right	1	..	1	

(*a*) In one box per 4 guns only.

APPENDIX 'A'—*contd.*

Detail.	Scale per sub-section.		Total per sub-section.	Remarks.
	1st box.	2nd box.		
Contents of spare parts box—contd.				
Packing, asbestos, pieces 5 yds. long.	2	2	4	
Pins, axis, trigger	1	..	1	
Pins, axis, tumbler	1	..	1	
Pins, firing	2	2	4	
Pins, fixing crank handle	1	1	2	
Pins, split, fixing collar roller	1	1	2	
Pins, split, keeper $\frac{1}{8}'' \times 2\frac{1}{4}''$	3	3	6	
Pins, split, keeper bush axis, side lever.	1	1	2	
Pins, split, keeper check nut long	2	2	4	
Pins, T. fixing rear cross piece	1	..	1	
Plugs, belt	1 (*b*)(*c*)	..	1 (*b*)(*c*)	
„ cork, complete	1 (*c*)	1 (*c*)	2 (*c*)	
„ front cover catch	1	1	2	
„ screwed	1	1	2	
Plungers, front cover catch	1	1	2	
Rollers	1	1	2	
Screwdrivers, large	1	..	1	
Sights, fore	1	1	2	
„ luminous, back and fore in tin box sets.	(*c*)(*d*)	(*c*)(*d*)	(*c*) (*d*)	*Vide* A. I. I. No. 865 of 1922.

(*b*) In one box per 2 guns only.

(*c*) Issued and indented for separately, not part of the contents of the spare parts box, case or wallet, as issued.

(*d*) Only 2 sets per unit are peace equipment, the remainder being mobilization equipment in unit charge which are not to be used in peace. These latter will be kept in the mobilization stores until the unit proceeds on service.

APPENDIX 'A'—*contd.*

Details.	Scale per sub-section. 1st box.	2nd box.	Total per sub. section.	Remarks.
Contents of spare parts box—contd.				
Sight, tangent	1	..	1	
Spanners, shifting	1	..	1	
Springs, bottom pawl	1	..	1	
,, cover lock	1	1	2	
,, front cover catch	1	1	2	
,, fusee	1	1	2	
,, gib	1	1	2	
,, lock	2	2	4	
,, safety catch with piston	1	1	2	
,, sear	1	1	2	
,, sliding, shutter catch	1	1	2	
,, tangent sight	1	1	2	
,, top pawl	1	1	2	
,, trigger bar	1	1	2	
Strips, long	25	..	25	
,, short	25	..	25	
Tools, belt repairing	1	..	1	
	1st case.	2nd case.		
Contents of spare parts case (*e*).				
Balances, spring	1	1	2	
Cans, oil, M. G.	1	1	2	
Flannelette (for first aid purposes).	8 yds. (*c*)	8 (*c*)	16 (*c*)	
Funnels, filling cylinder No. 1	1	1	2	
Levels, spirit, machine gun (complete with case)	1 (*c*)	1 (*c*)	2 (*c*)	
Locks	1	1	2	
Luting ozs.	6 (*c*)	6 (*c*)	12 (*c*)	
Plugs, clearing	1	1	2	
Springs, fusee	1	1	2	
Tools, combination	1	1	2	

(*c*) Issued and indented for separately, not part of the contents of the spare parts box, case or wallet, as issued.

(*e*) 1 is carried in each box.

APPENDIX 'A'—*contd.*

Details.	Scale per sub-Section. 1st box.	2nd box.	Total per sub-section.	Remarks.
Contents of wallet (*f*).	1st wallet.	2nd wallet.		
Corks for plug	1	1	2	
Cups, muzzle attachment	1	1	2	
Discs ,,	1	1	2	
Fusees with chains	1	1	2	
Gibs	1	1	2	
Packing, asbestos, pieces, 5 yds. long.	1	1	2	
Pins, axis, tumbler	1	1	2	
,, ,, trigger	2	2	4	
,, firing	3	3	6	
,, split, keeper, $\frac{1}{8}'' \times 2\frac{1}{4}''$	1	1	2	
Pliers, cutting. prs.	1 (*c*)	1 (*c*)	2 (*c*)	
Protectors, muzzle	1	1	2	
Pullthroughs, double	1	1	2	
Punches, No. 3.	1	1	2	
,, ,, 5.	1	1	2	
Reflectors, mirror, machine gun	1	1	2	
Screwdrivers, small	1	1	2	
Sears, with spring	2	2	4	
Springs, gib	2	2	4	
,, lock	1	1	2	
Triggers,	2	2	4	
Tumblers	3	3	6	
Washers, adjusting, No. 1, ·003	3	3	6	
,, ,, 2, ·005				

(*c*) Issued and indented for separately. Not part of the contents of the spare parts box, case or wallet, as issued.

(*f*) 1 is carried in each case.

II—

(*iv*).—*A. I. I. No. 240 of 1923.*

240. Scale of Vickers gun equipment for cavalry and infantry units in India.

With reference to Army Instruction (India) No. 473 of 1922, the scale of equipment, other than carrying equipment and spare parts, for Vickers guns of cavalry and infantry units in India will be as detailed in the Appendix to this Instruction.

2. Indents should be submitted to complete to this scale, but no additional expenditure should be incurred until funds have been specially provided for the completion of the measure.

APPENDIX TO ARMY INSTRUCTION (INDIA) No. 240 OF 1923.

Scale of equipment other than carrying equipment and spare parts for Vickers guns of cavalry and infantry units in India.

Item No.	Articles	Scale per unit. (Peace and War.)		Remarks.
		Cavalry.	Infantry.	
1	2	3	4	5
	Section 2-A.			
1	Blankets, I. P., 6 ft. × 6 ft. .	..	1 per mule.	
2	Buckets, water, G. S., canvas, I. P.	1 per horse.	1 per gun.	
3	Gear, picketing, cavalry, ropes, head.	1 ,,	,,	

(*iv*)—*contd.*

Scale of equipment other than carrying equipment and spare parts for Vickers guns of cavalry and infantry units in India—contd.

Item No.	Articles	Scale per unit. (Peace and War.)		Remarks.
		Cavalry.	Infantry.	
1	2	3	4	5
	Section 2-A.—contd.			
4	Hammers, peg picketing, I. P.	1 per 10 or less horses.	1 per 10 or less mules.	
5	Helves, maul, 34½ inch. .	1 per 6½ lb. pickaxe head.	1 per 6½ lb. pickaxe head.	
6	Hooks, bill, switching .	1 per 10 or less horses.	1 per 10 or less mules.	
7	Rugs, horse . . .	1 per horse.	1 per mule.	
8	Nets, forage . . .	1 ,,	3 per subsection.	
9	Pegs, picketing, I. P. .	2 ,,	2 per mule.	
10	Ropes, heel, 10½ feet .	..	1 per mule.	
	Section 2-B.			
11	Axes, pick, heads, 6½ lbs. .	2 per gun.	2 per gun.	
12	Shovels, G. S. . . .	2 ,,	2 ,,	
	Section 5-B.			
13	Bags, nose, pattern 1916, small.	2 per horse.	2 per mule.	Includes 1 for carriage of line gear.

(*iv*)—contd.

Scale of equipment other than carrying equipment and spare parts of Vickers guns of cavalry and infantry units in India—contd.

Item No.	Articles.	Scale per unit. (Peace and War.) Cavalry.	Infantry.	Remarks.
1	2	3	4	
	Section 5-B.—contd.			
14	Brushes, harness, hard .	1 per horse.	1 per mule.	
15	Brushes, horse . .	1 „	1 „	
16	Clippers, horse . .	..	1 per Vickers gun platoon.	
17	Clippers, horse, keys, adjusting.	..	1 per Vickers gun platoon.	
18	Combs, curry . . .	1 per horse.	1 per mule.	
19	Dusters (*a*) . . .	1 „	1 „	
	Harness pole draught, G. S. —			
20	Leggings, drivers . .	1 per pack leader.	..	
21	Whips			
22	Pads, roller, G. S. .	1 per horse.	1 per mule.	
23	Rollers, G. S. . . .	1 „	1 „	
24	Rubbers . . .	..	1 „	
25	Scissors, trimming, prs. .	1 per 10 animals or less.	1 per 10 animals or less.	
	Shackles, P. A.—			
26	Fore foot . . .	..	1 per mule.	
27	Hind foot . . .	..	1 „	
28	Sponge, 7 drachms (*a*) .	1 per horse.	1 „	

(*a*) Obtained locally and the cost defrayed out of the mule lines contingent allowance.

(*iv*)—contd.

Scale of equipment other than carrying equipment and spare parts for Vickers guns of cavalry and infantry units in India—contd.

Item No.	Articles.	Scale per unit (Peace and war). Cavalry.	Infantry.	Remarks.
1	2	3	4	5
	Section 8-D.			
29	Watches, stop, 1-5th second	1 per regt.	1 per bn.	
	Section 10.			
30	Covers, waterproof, 6½ft. × 6½ ft.	1 per horse	1 per mule.	
	Section 14.			
31	Cans, lubricating, No. 9, I.P	1 per gun	1 per gun	Carried in spare parts box.
	Section 15-B.			
32	Case No. 2 infantry range-finder.	1 per range finder.	1 per range-finder.	
33	Clinometers, Vickers gun .	1 per unit	1 per unit.	
34	Covers, No. 2 infantry range finder.	1 per range finder.	1 per range finder.	
35	Frogs, stand, No. 2 infantry range finder.	1 „	1 „	
36	Rangefinders, infantry, No. 2.	1 per unit	1 per unit.	
37	Stands, No. 2 infantry range finder.	1 per range finder.	1 per range finder.	

41

(*iv*)—contd.

Scale of equipment other than carrying equipment and spare parts of Vickers guns of cavalry and infantry units in India—contd.

Item No.	Articles.	Scale per unit (Peace and war).		Remarks.
		Cavalry.	Infantry.	
1	2	3	4	5
	Section 16-B.			
38	Belts, amtn., ·303-inch, 250 rds.	12 per gun	20 per gun.	
39	Boxes, belt, amtn., M.G. No. 8.	12 „	20 „	
40	Carriers, amtn. belt box, Mk. IV, tripod mouting.	1 „	1 „	
41	Case, spare barrel and cleaning rod, ·303-inch M. G.	1 „	1 „	
42	Chests, ·303-inch machine filling belts.	1 per machine.	1 per machine.	
43	Chests, Vickers or Lewis, ·303-inch M. G.	1 per gun	1 per gun	Peace only.
44	Guns, Vickers, ·303-inch— Handguard, barrel casing, I. P.	1 „	1 „	
	Guns, Vickers, ·303-inch—			
45	Adapters, condenser, steam.	1 per gun	1 per gun.	
46	Barrels (spare) (*b*) . .	2 „	2 „	
47	Condensers, steam . .	1 „	1 „	
48	Foresight, bar deflection .	1 „	1 „	

(*b*) Not to be used in peace. On receipt of orders to move, the worn barrel will be removed from the gun, returned to ordnance charge and replaced by one of these.

42

(*iv*)—concld.

Scale of equipment other than carrying equipment and spare parts of Vickers guns of cavalry and infantry units in India—concld.

Item No.	Articles.	Scale per unit (Peace and war.)		Remarks.
		Cavalry.	Infantry.	
1	2	3	4	5
	Section 16-B—concld.			
49	Plugs, test adapter, condenser, steam.	To be obtained on loan from the arsenal on which dependent.		
50	Sights, luminous, back, fore, in tin box sets.	*Vide* A. I. I. No. 865 of 1922.		
51	Levels, spirit, M. G., in case	1 per gun	1 per gun.	
52	Machines, filling belt, ·303-inch.	1 per 2 guns	1 per 2 guns	
	Mountings, tripod, ·303-in., Mk. IV.—			
53	Pins, joint, cross head .	1 per mounting	1 per mounting	
54	„ „ elevating gear	1 per mounting	1 per mounting	
55	Posts, aiming, zero, M. G. .	1 per gun	1 per gun.	
56	Protractors, M. G., No. 3 .	1 per 2 guns	1 per 2 guns.	
57	Rods, cleaning, ·303-inch, M. G.	1 per gun	1 per gun.	
	Section 27.			
58	Cartridges, S. A. ball, ·303-inch.	3,000 per gun.	5,000 per gun.	
	Weedon Section.			
59	Mallets, raw hide . .	1 per set of armourers tools.	1 per set of armourers tools.	

II—

(v) *A. I. I. No. 297 of 1923.*

297. VICKERS GUN EQUIPMENT.

Appendix C to Army Instruction (India) No. 322 1922 is reconstructed as shown in the Appendix to t Instruction.

APPENDIX TO ARMY INSTRUCTION (INDIA) No. 297 OF 1923.

Materials for the upkeep of Vickers gun, Home pattern, infan carrying equipment.

Item No.	Description.	Annually for 4 gun sets and 12 ammunition sets.	Purposes for which required.	Reserv materia for servic
1	2	3	4	5
	SECTION 5-B.			
	Packsaddlery, M. G., 303-inch.			
	Trees, adjustable—			
1	Bars, side shaped { near .	2	Saddletrees	1
	{ off .	2	,,	1
2	Racks, belt box, mark II, I. P.—			
3	Bands, { buckling piece	2	Racks .	1
4	belly. { point .	4	,,	2
5	Straps, stay { buckling	2	,,	1
	securing { piece			
6	boxes. { point .	4	,,	2

Materials for the upkeep of Vickers gun, Home pattern, infantry carrying equipment—contd.

Item No.	Description.	Annually for 4 gun sets and 12 ammunition sets.	Purpose for which required.	Reserve materials for service.
1	2	3	4	5
	SECTION 6-B.			
	Buckles, brass, roller—			
7	Double, 1″ . . doz.	0–2	General .	0–1
8	Single, 1½″ . . ,,	0–3	Hangers .	0–2
9	,, 1″ . . ,,	0–3	,, .	0–2
	Buckles, iron—			
10	Double, 1½″ ,,	0–2	General .	0–1
11	,, 1″ ,,	0–2	,, .	0–1
12	,, ¾″ ,,	0–2	,, .	0–1
13	Tinned single, 3″ ,,	0–2	,, .	0–1
14	roller. ,, 1½″ ,,	0–2	,, .	0–1
15	,, 1¼″ ,,	0–2	,, .	0–1
16	,, 1″ ,,	0–2	,, .	0–1
17	,, ¾″ ,,	0–2	,, .	0–1
18	Links, iron, tinned, with hooks. ,,	0–3	Pannels .	0–2
19	Leather, buffalo, curried, lb. heavy.	16	General .	4
	Rings, iron, tinned—			
20	with hooks . . doz.	0–3	Pannels .	0–2
21	1¼″ slight . . ,,	0–2	,, .	0–1
	Rivets, C. T.—			
22	½″ No. 6 S.W.G. . lbs.	0–6	General .	0–3
23	¼″ No. 6 S.W.G. . No.	24	Racks .	6
24	Squares, iron, tinned doz.	0–2	Head collars	0–1
25	Stops, iron, tinned . ,,	0–2	Reins .	0–1
26	Thread, flax, coarse . lbs.	1–0	General .	0–6
27	Web, worsted, 4 in. . yds.	5	Mark V girth.	..
28	Washers, No. 6 S.W.G. lbs.	0–3	General .	0–2
29	Wool, sheep, stuffing ,,	8	Pannels .	4

Materials for the upkeep of Vickers gun, Home pattern, infantry carrying equipment.

Item No.	Description.	Annually for 4 gun sets and 12 ammunition sets.	Purpose for which required.	Reserve materials for service.
1	2	3	4	5
	SECTION 8-A.			
30	Twine, quilting . lbs.	0–6	Pannels .	0-3
	SECTION 9-A.			
31	Beeswax . . ,,	0–3	..	0-2
32	Dubbing . . ,,	32	..	16
33	Glue, Cawnpore . ,,	0–3	..	0-3
34	Soap, yellow . . ,,	64	..	32
35	Wax, black . . ,,	0–3	..	0-2
	SECTION 10-A.			
	Rivets-steel—			
	Bosshead—			
36	$\frac{3}{16}$ in. × $\frac{1}{2}$ in. . ,,	0–6	Racks .	0-2
37	$\frac{1}{4}$ in. × $\frac{1}{2}$ inch. . ,,	0–6	,, .	0-2
38	Countersunk head $\frac{1}{4}$ in. No. × $1\frac{1}{2}$ in.	14	Saddletrees	4
39	Round head $\frac{1}{4}$ in. ,, No. 6 S.W.G.	14	,, .	4
	SECTION 13-C.			
40	Dowlas, 27″ tan . yds.	4	Pannels .	3

Note.—The quantities shown in column 5 will be supplied as a first issue and maintained subsequently from the annual allowance shown in Column 3.

(vi) *A. I. I. No. 361 of 1923.*

361. MATERIALS FOR THE MAINTENANCE OF MACHINE GUNS AND ACCESSORIES.

The annual allowance of materials for the upkeep of all machine guns is given below. No extra expenditure is involved :—

Item No.	Article.	Annually, per gun.		Reserve material for service (per gun.)
	Section 2-A.			
1	Doosootie (old) .	lbs.	3	$1\frac{1}{2}$
	Section 3.			1 rod.
2	Wire, twisted, copper rod.	..	1 per 4 guns (*a*).	(*a*) 42 inches long, of wire 0·1 inch in diameter in a double twist.
	Section 9-A.			
3	Dubbing . .	lbs.	0·8	0·4
4	Mineral jelly (red) .	,,	2·6	1
5	Oil, lubricating, G.S.	pints	8	4
6	Soap, yellow . .	lbs.	8	4
7	Turpentine . .	pints	1	$\frac{1}{2}$
8	Wick, round, $\frac{1}{4}$″ diameter.	oz.	2	1
	Section 13-C.			
9	Cotton, waste white	lbs.	4	2
10	Flannelette . .	yds.	$11\frac{1}{4}$	$11\frac{1}{4}$

2. The quantities shown in column 4 will be supplied as a first issue and maintained subsequently from the annual allowance shown in column 3.

3. Appendix "A" to Army Instruction (India) No. 522 of 1922 is hereby cancelled.

(*vii*) *I. A. O. No. 1035 of 1921.*

1035. *Equipment—Ordnance.*—Inspection of Machine Guns. Officers Commanding units, etc., having machine guns (Vickers, Maxims, Hotchkiss and Lewis) on charge will take necessary action to ensure that India Army Form Q. 1454-A., referred to in paragraph 850, Army Regulations, India, Volume II, is maintained as a record of the monthly inspection of all machine guns on charge and that this form is produced at the inspection of these guns by the C. C. M. A.

35979 (Q. M. G.-11-B.)

(*viii*) *I. A. O. No. 494 of 1922.*

494. *Machine gun components.*—When machine gun components are unfit for service but are considered suitable for instructional purposes, disposal orders will be demanded on a separate sheet of India Army Form Z-2098, with a note on the form "fit for D. P. guns."

35668 (Q. M. G.-11-B.).

(*ix*) *I. A. O. No. 818 of 1922.*

818. *Machine Gun Barrels.*—Only new barrels of Lewis, Hotchkiss and Vickers machine guns, which have been modified in accordance with India List of Changes, Section 9883, will in future be held as mobilization equipment in unit charge and for Ordnance War Reserves. For identification purposes, these barrels are marked "S. C." in the position stated in India List of Changes, Section 9883.

35756 (Q. M. G.-11-B.).

2. During peace unmodified barrels will be used until stocks are exhausted. When the barrel in the gun becomes unserviceable, an unmodified barrel will be demanded in replacement. Where modified barrels are already fitted to guns in possession of units and have been used for ball firing, such barrels will be used until unserviceable and then be replaced by unmodified barrels.

3. In order that the necessary adjustments may be made, units will report, to Chief Ordnance Officers concerned, the

numbers of modified and unmodified barrels actually in possession. Chief Ordnance Officers will then take steps firstly, to complete Ordnance War Reserves with modified barrels and, secondly, to adjust units' equipment as far as possible, reporting inabilities to the Director of Equipment and Ordnance Stores.

(*x*) *I. A. O. No. 209 of 1923.*

209. *Boxes, belt, Ammunition, M. G.*—Belt boxes for Vickers guns will be issued as follows :—

35033 (Q. M. G.-11-B.).

No. 6 boxes—Will be issued to all armoured car companies and all machine gun sections and light motor patrols of the Auxiliary Force until stocks are exhausted, when they will be replaced by the No. 8 box.

No. 7 boxes—Will be issued to all cavalry and infantry units, other than those of the Field Army and Covering Force, equipped with carrying equipment as detailed in the annexures to Army Instruction (India) No. 85 of 1923, until stocks are exhausted, when they will be replaced by the No. 8 box.

No. 8 boxes—Will be issued to all cavalry and infantry units of the Field Army and Covering Force, and will be the pattern to be held in reserves.

Mark II, P. T. boxes—Will be issued to all infantry units (including units of the Auxiliary Force) equipped with the Indian pattern carrying equipment, until this equipment is replaced by that detailed in Army Instruction (India) No. 85 of 1923. They will then be exchanged for the No. 7 or 8 boxes.

2. Indents to adjust equipments in possession will be submitted.

SECTION IV-B.

Reference numbers of A. I's. I. and I. A. O's. (in addition to those reproduced in full in Section IV-A). containing information regarding Vickers guns.

With reference to.	Number of A. I. I. or I. A. O.
Scale of issue of Vickers machine guns .	A. I. I. No. 473 of 1922.
Re-browning and re-painting of Vickers machine guns.	A. I. I. No. 624 of 1922.
Vickers machine guns for Drill purposes	A. I. I. No. 79 of 1923.
Scale of issue of Vickers machine gun carrying equipment.	A. I. I. No. 85 of 1923. [See section I. A. (1)].
Scale of issue of hand-books . .	I. A. O. No. 1341 of 1921.
Packing of mark IV tripod mountings for transit purposes.	I. A. O. No. 96 of 1922.
Vickers machine gun annual course .	I. A. O. No. 603 of 1922.
Scale of issue of Vickers machine gun diagrams.— (*a*) Feed block . . . . (*b*) Three positions of lock.	I. A. O. No. 4 of 1923.
Scale of issue of Vickers machine gun diagrams. (Barrel casing).	I. A. O. No. 81 of 1923.

SECTION V.

MISCELLANEOUS INFORMATION

(i) *Courses to be fired by Vickers gunners.*

The Machine gun course is as laid down in M. G. Training modified for India by I. A. O. No. 603 of 1922. Instructions regarding rifle and revolver courses are contained in a Memorandum No. 14039-2-M.T.—1, dated March 1st, 1923, issued by the General Staff, Army Headquarters.

(ii) *Administration of the Indian personnel of British Infantry Battalions.*—

Information regarding the recruitment and administration of the Indian personnel of British Infantry Battalions is contained in a pamphlet issued by the Adjutant-General's Branch, Army Headquarters, entitled 'Notes on Indian personnel of British Infantry Battalions.'

(iii) *Vickers gun information. (Questions and answers).*—

A series of questions and answers that have arisen from time to time on the administration and equipment of Vickers gun platoon has been published and issued to units by the Commandant of the Machine Gun School, Ahmednagar. The pamphlet is entitled 'Vickers Gun Information. (Questions and Answers).'

G. M. P., Simla.—No. M17 CGS—3-7-23—1,800—J.N.M., etc.

G; G; S./14848/M. T. I.

CO-OPERATION

OF

ARTILLERY WITH OTHER ARMS

STANDARDIZATION OF WORDS OF COMMAND

INDIAN SUPPLEMENT, 1923

I.A.O.234. 21-3-24. BOOKS - CO-OPERATION OF ARTILLERY WITH OTHER ARMS - STANDARDIZATION OF WORDS OF COMMAND.- With reference to India Army Order No. 197-I. of 1924 as The Horizontal Clock Code will be used in India, the following corrections are made to the above publication and copies will be corrected accordingly.-

Page 1, para. 1, line 8, for "Appendices A and C" substitute "Appendix A".

Page 2, sub-para. (e), delete present entry form "By the" to "(Appendix C.)" and substitute "By the horizontal clock code."

Page 3, delete from "The system" to "in India."

Pages 4 and 5, delete "Appendix C."

2. India Army Orders Nos. 271 of 1922 and 82 of 1923 are hereby cancelled.

These instructions are issued by order of the Government of India.

E. BURDON,

DELHI:
17th November 1923. } *Secretary to the Government of India, Army Department.*

Co-Operation of Artillery with other Arms—Standardization of Words of Command.

INDIAN SUPPLEMENT.

1.—(*a*) In order to secure the close co-operation of batteries or detached sections of artillery with other arms in battle with reference to:—

(i) The location and description of objectives on which it is desired to bring artillery fire to bear;

(ii) The correction of artillery fire which cannot be observed by any officer of the artillery unit firing;

it has been decided that the methods given in Appendices A and C shall be adopted forthwith and will be used for training in peace.

(*b*) It has further been decided that the terms used for either of the purposes described in (*a*) (i) and (ii) above, and the terms used as words of command by cavalry, artillery and infantry in analogous circumstances shall be standardized, and also that the terms and words of command with their standardized meanings as given in Appendix B shall be adopted and be taken into use forthwith.

2. These instructions will be included in the revised editions of training manuals when issued, but, pending the receipt of the revised editions, all commanders will ensure that the methods and standardized words of command issued herewith are adhered to.

APPENDIX A.

INDICATION OF TARGETS.

Targets can be pointed out—

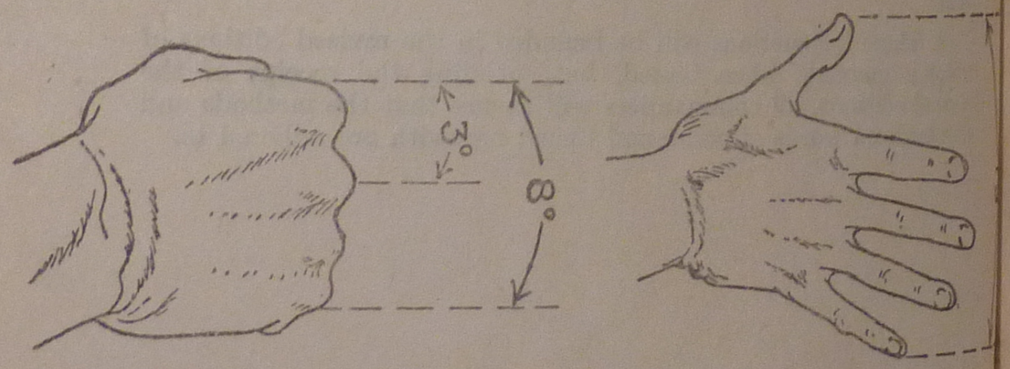
(*a*) By laying a rifle or director on the target.
(*b*) By description.
(*c*) By the vertical clock code.
(*d*) By map co-ordinates.
(*e*) By the ~~horizontal clock code~~ system laid down in India Army Order No. 271 of 1922 as amended by India Army Order No. 82 of 1923 (see Appendix C.).

(*a*), (*b*) and (*c*) are suitable when the parties concerned are within reach of each other ; (*d*) and (*e*) when they are separated and do not know each other's positions.

VERTICAL CLOCK CODE.

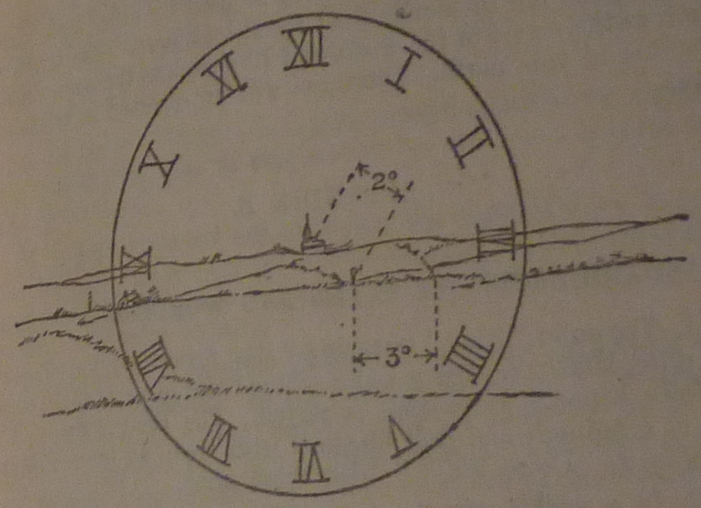
The vertical clock code is the normal method of indicating the position of a target to officers and men in the vicinity of an observer or the officer in charge.

A fixed point in the landscape is selected as the "reference point". This point is taken as the centre of a clock hanging vertically ; the position of any object with reference to it can be indicated by the figuring of the face and by measuring the angular distance in degrees between the reference point and the target. The angular distance can be measured with graticuled field glasses or by the use of the hand, thus :—



All Officers, N.C.Os. and men should know what angles are subtended by various parts of their own hand when placed at arm's length ; for purposes of instruction a degree scale calculated for a given distance and painted on the wall should be used.

EXAMPLE.



Reference point : Church Spire. Target : Trench ; left of target : 4 o'clock—2°, extent of target—3°.

HORIZONTAL CLOCK CODE.

The system laid down in I. A. O. 271 of 1922 as amended by I. A. O. 82 of 1923 (*See* Appendix C) will remain in force in India.

The horizontal clock code is the normal method of describing the position of a target to an observer at a distance when the target cannot be accurately located by co-ordinates on a squared map.

A fixed point in the landscape is selected as the "reference point". This point is taken as the centre of a horizontal clock, and 12 o'clock is the approximate direction of true north ; the position of any object with reference to it can be indicated by the figuring of the face and by estimating the distance in yards between the reference point and the target.

The advantage of this method is that the receiver of the message need not know the sender's position.

Wherever possible the place or places from which the target can be seen should be stated, or information given as to where a guide can be procured to lead the artillery observing officer to a point whence he can see the target. This gives the artillery observing officer a chance of having the target definitely pointed out to him.

4

CORRECTION OF ARTILLERY FIRE.

The horizontal clock code should be used by other arms when reporting the fall of rounds fired by the artillery. The target is taken as the centre of the clock, and 12 o'clock is the approximate direction of true north. Distances will be reported in estimated yards.

APPENDIX B.

STANDARDIZATION OF TERMS AND WORDS OF COMMAND.

1. The order "Stop" (meaning "stop firing") will be adopted for rifles, Hotchkiss, Lewis and Machine Guns in place of the order "Cease Firing" at present employed. The order "Stop" will imply conditions and drill identical with those at present appertaining to "Cease Firing" with those arms.

2. In a similar way the order "Go on" will be employed to replace the order "Continue".

3. The order "Cease Firing" will be adopted to replace the order "Out of action" with its consequent duties.

4. The expression "Out of Action" will be used only to intimate that the weapon is incapable of firing.

5. The signals and bugle calls as at present employed will continue to stand with the new equivalents.

6. The signal as now used with machine guns representing "Stand by for firing" will be adopted for Hotchkiss and Lewis Guns instead of that at present in use.

7. The alterations may be summarized as under:—

Present words of Command for Rifle, Lewis Gun and Machine Gun.	New words of Command.
(*a*) "Cease Firing"	"Stop".
(*b*) "Continue"	"Go on".
(*c*) "Out of Action"	"Cease Firing".
(*d*) "Out of Action" will be used only to indicate that the weapon in question is temporarily or permanently incapable of firing.	

APPENDIX C.

India Army Order 271 of 1922 as amended by India Army Order 82 of 1923.

5

SYSTEM OF INDICATION OF TARGETS BY INFANTRY TO ARTILLERY.

India Army Order No. 858 of 1921 is hereby cancelled.

The following system of indicating targets by Infantry to Artillery and of sending observations of the fall of rounds will be adopted whenever practicable:—

1. *Indication of target.*—In a well-mapped country the observer will ordinarily indicate to the battery his own map position and that of the target.

When good maps are not available, the observer must be in a position to see the battery or be able to place, in close proximity to him, a signalling post, which can see the battery and which is in the line observer battery.

The observer will consider himself at the centre of a clock and the battery at 6 o'clock. In the message he sends to the battery he will describe the target, indicating its direction by the clock-code and its distance from him in yards; thus in the case of machine guns holding up the advance from a position 800 yards to his right front, the message will be "Machine guns two 800".

2. *Observation of Fire.*—For observation of fire the observer will consider himself at 6 o'clock on a clock circle of which the target is the centre and will send the results to the battery by the clock-code, giving the distance of the fall of the rounds from the target in yards, *e.g.*, he observes a round fall 100 yards to the right of the target and therefore signals "three 100."

SGPI—M—VI-4(34)—8-12-23—18,000.

Extract from Eastern Command Orders, dated 28-10-24.

No. 574 ORDNANCE.

For the supply of fuel, etc. for browning arms, units come under one of the following categories:-

(a) Units which are entitled to annual allotments for the purchase of petty supplies vide A. D. letter No. 11713-7 (Q.M.G. 5) dated 22-8-1913.

(b). Units which are not entitled to annual allotments for the purchase of petty supplies.

2. With the exception of fuel, charcoal and quicklime, materials, for browning arms are supplied free by the State vide para 133 and appendix 26 of Equipment Regulations (India) Part I (1923) to both the above categories.

3. In the case of units falling under category (a), fuel, charcoal and quicklime, and other articles enumerated on I.A.F.S-1594, are to be purchased from the fixed allotments.

4. As regards category (b) in supersession of the instructions contained in Eastern Command Order No. 337 of 1924 it has now been recognised that these units cannot meet the expenditure connected with fuel for armourers shops, charcoal, quicklime, wood, oil common dark; from the monthly allowances sanctioned in A.Is. (I) Nos. 322 and 849 of 1922, and as a solution to the difficulty, it ~~is~~ is proposed to lay down definite scales of these articles and issue them free to units.

In order that the necessary sanction of the Government of India may be obtained Headquarters Districts and Independent Bdes. will report the scale recommended, with due regard to the instructions contained in para 133 of Equipment Regulations India 1923, and also forward through the C.M.A. concerned, an estimate of the extra expenditure involved. Reports should reach Command Headquarters by 15th December.

5. Until such time as definite scales are fixed in the case of units coming under category (b) fuel, charcoal, quicklime etc. should be issued free to them on as "as required" basis, the expenditure incurred under the sanction of the c f, a. and met from the provision made under Head I-A (I)-Miscellaneous "Miscellaneous Expenditure incurred regimentally on account of Stores" in current year's budget.

(A.H.Q. No.48891/Q-6 dated 8th October 1924).

Extract from Equipment Regulations, India, Part I, 1923.

196. Scale of paint for Lewis and Vickers machine guns.

Articles	Parts to be painted	Allowance per 100 for one coat.
		lbs.
Guns, machine, Lewis, 303-inch.	Radiator casings and exposed surfaces of trigger guard.	4¼
Guns, machine, Vickers, 303-inch.	Barrel casing and exposed surfaces of feed block when latter is of gun-metal.	4¼
Magazines, Mark I, Lewis, 303-inch M. G.	Externally only .	1⅛
Mounts, field, Lewis, 303-inch, M.G. Mark III.	All over . . .	1½
Mountings, tripod, 303-inch M.G., Mark IV (including carriers ammunition belt box).	All over, excepting gun and joint pin bearing surfaces. screw threads of elevating gear and stems of joint pins.	12
Boxes, belts, ammunition M.G. Nos. 7, 8 and 9, Mark I(metal).	Externally (and internally where necessary).	11
Boxes, carriers, magazines, Lewis, 303-inch M. G. (metal).	ditto ditto .	19½
Chests, machine, filling 303-inch, belts No. 1, Mark III (wood).	Externally. . .	14
Chests, Vickers or Lewis 303-inch, M.G. (wood).	" . . .	25

9229
C. G. S.

Machine Gun Drill

1920.

(*Provisional.*)

(Extract from Machine Gun Training, 1920.)

Reprinted and issued by the General Staff, India.

CALCUTTA
SUPERINTENDENT GOVERNMENT PRINTING, INDIA
1921

MACHINE GUN DRILL.

AIMING INSTRUCTION.

The soldier must be instructed on the lines laid down in this section before he commences "sight setting and laying" in elementary gun drill.

1. Kit required: Gun, tripod, belt box, aiming disc, miniature bull's-eye target, figure and landscape targets.

2. The instructor should first impress upon the squad the importance of correct aiming, from the machine gun point of view.

3. The use of the sights—to obtain direction and elevation—will be explained.

4. The method of adjusting the sights will be demonstrated and explained. Fifty yards will be taught as the smallest adjustment. The instructor should impress upon the men that the correct line on the graduated plate for any particular range is the one *under* the figures indicating that range. The men should be required to make several adjustments.

5. The following rules for aiming will then be given, and diagrams used to make the explanation clear:—

(*a*) Sights upright. This is obtained by correct mounting of the tripod (*see* Elementary Gun Drill, para. 7).

(*b*) Master eye used.

(*c*) Blade in centre of "U," and tip in line with shoulders.

(*d*) Subject to atmospheric conditions, aim will be taken at that part of the target on which it is desired the nucleus of the beaten zone shall fall.

(*e*) Eye about 6 inches from rear crosspiece.

6. A miniature bull's-eye target will then be placed about 10 yards away. The instructor will lay a correct aim without "holding." He will explain that direction is obtained by tapping the traversing handles, and that the elevating wheel must be turned in order to elevate or depress the gun. Whilst laying the chin must be supported on the hand. A belt box may be placed across the knees and the elbows rested on the box, or the box may be placed on the ground, resting on end, and the arms rested on the top.

7. Every man should then view the aim, after which the men themselves, in turn, will lay the gun. They will not "hold" the gun during this lesson. The reasons for taking a regulation aim should be explained.

Should any faults be detected, the instructor will point out what effects they would have on shooting, and will see that such faults are remedied.

8. When sufficient progress has been made, the men must be tested by the "Triangle of Error" test. The method of carrying out this test, and the qualifying standard will be the same as described and laid down in Musketry Regulations (Sec. 39), except that a gun and a Mark IV, tripod will be used instead of a rifle and aiming rest.

9. After passing the test (Musketry Regulations, para. 299, sub-para. v), the correct method of "holding" the gun will be shown and explained. The following points in connection with "holding" should be impressed upon the men :—

(*a*) The correct method of holding the traversing handles is with the third and little fingers round the handles, second fingers behind the safety catch, forefinger on top, and thumbs resting lightly on the thumbpiece; except when the gun is laid, when the safety catch should be raised with the second fingers.

(*b*) The elbows should, whenever possible, be supported by the inside of the thighs.

10. The instructor will then give a demonstration of laying with "holding," after which the men, in turn, will practise. They will be told that there should be practically no difference in aim with or without holding.

NOTE.—When checking an aim the instructor should rest one finger lightly on top of the traversing handle.

11. When the men can aim correctly, using a bull's-eye target, similar practice will be given on figure targets, then on landscape targets, and finally on natural features in the open country.

A perfect aim must be insisted upon at all times.

12. The method of aiming with the aperture pattern of "fixed sight" will be taught when the ordinary sight has been mastered. The system of instruction will be as described below :—

(*a*) Illustration of a correct aim by diagram.

(*b*) Used up to 500 yards, for all targets, except point targets, *e.g.*, loop-hole.

(*c*) Rules for aiming :—

i. Sights to be upright (*see* Elementary Gun Drill, para. 7).

ii. The master eye to be used.

iii. The tip of the foresight in the centre of the aperture and the aim taken at that part of the target on which it is desired the nucleus of the beaten zone shall fall.

(*d*) Method of instruction :—

i. Half-inch bull's-eye target at 10 yards.

ii. Rest for pupil's head (as in para. 6).

iii. Instructor lays a correct aim.

iv. Pupil views that aim.

v. Pupil lays aim; instructor criticises.

Men should be instructed to look through the aperture and not at it; also to note the field of view, which should be as shown in the diagram.

NOTE.—Faults in aiming can be readily pointed out as follows:—The instructor holds a piece of white paper in front of the foresight, obliterating the aiming mark, and instructs the pupil to look along the sights, taking care that the foresight is kept in correct relation to the backsight; he then removes the paper for a few seconds while the pupil notes where the line of sight strikes the target.

ELEMENTARY GUN DRILL.

1.—Elementary gun drill will consist of the following :—

i. Mounting the gun.
ii. Dismounting the gun.
ii. Loading.
iv. Unloading.
v. Coming into action.
vi. Sight setting and laying.
vii. Coming out of action.
viii. Traversing and searching.
ix. Mounting and dismounting the gun in the lowest position.

In order that training may be progressive this sequence should be adhered to.

2.—Kit required for each gun team.

Gun, Mark IV tripod, belt box with belt and dummies, spare parts case complete, landscape target (if natural panorama is not available), and target for Part I of the annual machine gun course.

3.—Laying out of kit.

i. The gun and tripod will be placed in line on the ground about 3 paces apart and about 30 yards from the landscape target.
ii. Tripod on the left, legs to the rear.
iii. Gun on the right, muzzle pointing to the front.
iv. Spare parts case alongside and on the right of the gun.
v. The belt box about 3 paces in rear of the interval between gun and tripod.

4.—"Fall In."

On the command "Fall In" each detachment will fall in, in single rank, and stand at ease, about 5 paces in front of the kit. (Plate .)

5.—"Number."

On the command "Number" the detachment will spring to attention and number as in squad drill. The detachment will be cautioned that the No. 1 *will repeat all subsequent orders*, and that No. 2 will convey all signalled orders to No. 1.

6.—"Take Post."

On the command "Take Post" the gun detachment will turn to the right and move at the double to positions as follows :—No. 1 will pass behind the gun and tripod and fall in on the left of the tripod. No. 2 will fall in on the right of the gun. No. 3 will fall in on the left of the ammunition box. The remaining numbers will fall in about 5 paces in rear of No. 3, No 4 being on the right. When the state of the ground permits all numbers will lie down. (Plate .)

As soon as the No. 1 arrives at his position he will see that the elevating and cross-head joint pins are properly in position and turned down, and that both elevating screws are equally exposed, clamps tight, strap round rear leg and buckled, traversing clamp sufficiently tight to prevent the cross-head from swinging round when the tripod is being carried, direction and elevation dials secure.

No. 2 will at once attend to the following points :—Cork plug in, sliding shutter closed, front cover locked, "T" fixing pin screwed home and vertical, tangent sight set at 600, muzzle attachment correctly adjusted, and will sling the spare parts case across his right shoulder, first making certain that the contents are complete. (The Inspection of the spare parts case is carried out twice only during drill—by the first No. 2 and by the last No. 2.) Care must be taken that the strap passes underneath the box respirator, if the latter is worn in the alert position.

No. 3 will examine the belt, see that the dummies are correctly placed in position and pointing the right way, and will then close the box. The catch of the ammunition box will be towards the front. He will then report "Ammunition correct" to No. 2, who will then report "Gun and ammunition correct" to No. 1, who in turn will report "All correct" (or otherwise) to the instructor.

7.—"Mount Gun."

NOTE.—The instructor will now bring the detachment to the left of the position where the gun is to be mounted, so that they may see all movements clearly and listen to explanations. He will then act as No. 1 himself, giving and repeating the order "Mount Gun," and will point out a position, which will be about 25 yards from the target, where the gun is to be mounted.

(*a*) *To erect the tripod.*—On the command "Mount Gun" No. 1 picks up the tripod, doubles forward to the position indicated and places it in position. Whilst adjusting it the following points must be attended to : The cross-head bracket should be held by the left hand, close to the socket, the left forearm being supported by the left thigh, and both the jamming handles should, if possible, be manipulated with the right hand. (Plate .)

When the tripod is mounted the socket must be upright, the clamps tight, the tripod a convenient height for the firer when in a sitting position, and the rear leg in line with the target. No. 1 will sit down behind it and remove the elevating and cross-head joint pins whilst doing so.

(*b*) *To dismount the tripod.*—No. 1 springs up and doubles back to the original position with the tripod. He will then replace both pins, taking care that they are properly in and turned down, loosen the jamming handles, fold the legs and clamp them together again. He will then stand to "Attention" on the left of the tripod (or lie down).

NOTE.—Before dealing with the action of No. 2 all the members of the detachment should be practised in erecting and dismounting the tripod. When they have made reasonable progress with the tripod the instructor will then continue the instruction in "Mount Gun." He will order one of the detachments to erect the tripod and will then himself act as No. 2.

(*c*) *To mount the gun.*—No. 2 picks up the gun, taking care not to dig the muzzle attachment into the ground whilst doing so, and opens the sliding shutter. Then, holding the right traversing handle with the left hand and carrying the barrel casing under the right arm, he doubles forward to the tripod, arriving about the same time that No. 1 is removing the elevating and cross-head joint pins. He then kneels on his left knee, places the gun on the tripod, supporting the barrel casing with the right thigh, and with his right hand he drives in the cross-head joint pin, handle upwards, and when

it is home he turns the handle down. He retains his hold with his left hand on the right traversing handle until the pin is home and then releases hold. (Plate .) (No. 1 having meanwhile grasped the left traversing handle with his left hand.) If the condenser is being used, No. 2 pulls out the cork plug. Meanwhile No. 1 similarly puts in the elevating joint pin and turns it down.

No. 2 then lies down on the right of the gun, places the belt box in position in line with the feed block, and sees that the strap on the box is clear of the lid, or, if a metal box is used, that the quick release strap is disengaged.

After putting in the elevating joint pin No. 1 will at once level the gun test the traversing clamp to see that it is "sticky," and then sit with elbows resting inside the thighs and holding the traversing handles correctly. Eyes must be directed towards the target and not at his hands or gun.

NOTE.—The instructor will then act as No. 3.

No. 3 will double forward with the ammunition box and place it conveniently for No. 2, *i.e.*, the catch (or quick release strap) towards the gun and the box placed in such a position that No. 2 is not likely to knock it over as he lies down. The ammunition box must be at hand directly No. 2 is ready for it.

No. 3 then doubles away, taking care not to take up a position directly behind the gun. If cover is convenient he should take advantage of it.

When the gun is mounted and the Nos. 1, 2 and 3 are in position, the following points should be criticised by the instructor :—

i. Action of Nos. 1, 2 and 3 until the gun is mounted.
ii. Rear leg of the tripod in line with the target.
iii. Shoes, not legs, of the tripod on the ground.
iv. Jamming handles tight.
v. Socket upright.
vi. Traversing clamp sticky.

NOTE.—This must be tested by the instructor in the same way that the No. 1 tests it, *i.e.*, by tapping the traversing handle.

vii. Pins properly in and turned down.
viii. Elevating screws equally exposed.
ix. Elevation dial secure.
x. Tripod a suitable height for the firer.
xi. Gun level and pointing towards the "front."
xii. Cork plug out (if the condenser is being used).
xiii. Front cover locked.
xiv. Sliding shutter open.
xv. Tangent sight slide at 600 yards.
xvi. No. 1 sitting and holding the gun correctly.
xvii. No. 2 lying down, with his head below the level of the gun, spare parts case slung across his shoulder, with strap underneath the box respirator if worn in the alert position.
xviii. Belt box in correct position with the strap clear of the lid; or, if a metal box is used, with the quick release strap disengaged.
xix. No. 3 lying down in rear and to a flank.

NOTE.—When the instructor criticises, the faults each number has committed should be pointed out to the whole detachment.

8.—"Dismount Gun."

NOTE.—Here again, the instructor will demonstrate the duties of each number in turn.

On the command "Dismount Gun" No. 1 will remove both pins, and as soon as No. 2 has removed the gun, he will stand up, replace both pins, loosen the jamming handles, fold up the legs and tighten the jamming handles, and, if necessary, align the cross-head arm over the rear leg.

No. 2 will push the belt box away from the tripod, lift the gun from the tripod, and replace the cork plug. Before placing the gun on the ground he will close the sliding shutter. He will finally re-set the sight at 600 yards if necessary.

9.—"Load."

NOTE.—The instructor will act as the No. 1 and then as the No. 2, the detachment standing near the gun.

On the command "Load" No. 1 pulls the crank handle on to the roller with the right hand, and advances his left hand to the left of the feed block, ready to grip the belt.

No. 2 opens the belt box, holds the end of the belt (at the point where the brass tag joins the fabric) with his forefinger (right hand recommended) along the tag, and pushes the tag through the feed block as far as possible.

NOTE.—With the metal belt boxes, both halves of the lid will be opened One half may be closed later if necessary.

No. 1 grips the tag, and pulls the belt through the feed block as far as possible. He must pull the belt *slightly* to his left front when doing so. He then releases the crank handle, taking care not to allow his right hand to move forward with it. He again pulls the crank handle on to the roller, pulls the belt slightly to his left front, and releases the crank handle. Whilst pulling the crank handle on to the roller the belt will be held (but not pulled) with the left hand. He then resumes his holding on the gun.

NOTE.—The instructor should explain that the pulling of the belt slightly to the left front is only to avoid the natural tendency to pull it to the rear, *i.e.*, towards the No. 1, and that to pull the belt too much to the left front or with much force must be guarded against.

10.—"Unload."

NOTE.—The instructor will perform the duties of No. 1 and then of No. 2, the detachment standing near the gun.

On the command "Unload" No. 1 will pull the crank handle on to the roller, and immediately allow it to fly forward again. Should the tangent sight be up, it will be lowered at the same time with the left hand. He will repeat this movement. He will then press the top and bottom pawls of the feed block with the right hand, the top pawls being pressed with the thumb, and the bottom pawls with the fingers, taking care to keep the hand clear of the entrance to the feed block. No. 2 will withdraw the belt and pack it carefully in the box. When the last round is clear of the feed block No. 1 will press the thumbpiece with the left hand. The wooden box must be locked. but with the metal box the lids need only be closed, not locked.

NOTE.—All numbers should now be practised in loading and unloading until reasonable progress is made. Should any man exhibit a tendency to slur the loading motions, it may be advisable to make him load "by numbers," counting aloud whilst doing so.

11.—"Action."

When the men have made sufficient progress in the foregoing lessons they will be exercised in coming into "Action." The instructor will indicate the "front," define the "arc of fire," and give the command or signal "Action." The gun will then be mounted with reference to the "front" and loaded, and when the No. 2 puts up his hand, the various points taught in previous lessons will be criticised.

12.—To adjust the sights.

NOTE.—Before this lesson and the next are dealt with, instruction in aiming must have been given (Sec. .)

On the range being given, No. 1 will raise the tangent sight (unless the range is 500 yards or under, when the fixed sight will be used), and adjust the slide to the range ordered.

13.—To lay the gun.

On the target being indicated by the instructor, No. 1 will tap the gun over until the correct direction is obtained, and elevate or depress until the aim is correct. Should a large change in direction be necessary, No. 1 will order No. 2 to loosen the traversing clamp, and will swing the gun roughly on to the target, order No. 2 to tighten, and then lay accurately by taps. It is most important that whilst tapping the gun, or manipulating the elevating wheel, the correct "holding" should be maintained with the other hand.

As soon as the aim is correct and the correct holding taken, No. 1 will, by the word "Up," order No. 2 to put up his hand. (Plate .)

NOTE.—After the instructor has given a demonstration of how to lay the gun all the men will be exercised.

Care must be exercised when checking the aim to prevent the gun from being moved as the No. 1 moves his head to one side to allow the aim to be viewed by the instructor.

14.—"Fire."

On the command or signal "Fire" being given, No. 2 will tap No. 1 lightly on the back and say "Fire" and No. 1 will instantly press the thumbpiece. He must press it in as far as possible.

The thumbpiece must be pressed in by a quick and even movement of the thumbs, and the eyes must be directed at the target. The tendency to look down at the thumbpiece must be checked.

15.—"Cease Fire."

On the command or signal "Cease Fire" being given No. 2 will tap No. 1 lightly on the back and say "Cease Fire" and No. 1 will at once release the safety catch and release the pressure on the thumbpiece. He should then check his aim, and correct it if necessary.

16.—"Out of action!"

The gun will be unloaded and dismounted on the spot.

On service No. 3 might not be required, Nos. 1 and 2 dealing with the belt box or boxes, as circumstances suggest.

17.—Traversing.

The gun will be mounted 25 yards from the target as used in the Annual Machine Gun Course, Part I, before instruction begins; and the fact that the bull's-eyes are four inches apart must be pointed out to the men.

The instructor will explain that the object of the exercise is to develop a consistent, automatic tap, and to teach the degree of tightness required in the traversing clamp, in order that the line of sight may be displaced fifteen minutes each time the gun is tapped.

The following points will then be explained:—

i. A strong tap with a tight clamp is much preferable to a weak tap with a loose clamp.

ii. When tapping with either hand the gun must be held correctly with the other hand, and the safety catch kept raised.

iii. Eyes must be directed at the target the whole time, and not at the rear end of the gun or along the sights, except momentarily for checking the aim.

iv. If the gun moves too much or too little, the *traversing clamp* must be altered, *not* the tap.

Between each tap, the thumbpiece will be pressed about two seconds, which is the time required to fire a group of 10 to 20 rounds.

The instructor will then show how he tests the traversing clamp, and give a demonstration of traversing. All numbers will then be exercised, tapping with the left as well as with the right hand; the tangent sight will be raised, but not used, during the execrcise.

18.—Searching.

The gun will be mounted 25 yards from the target, as used in the Annual Machine Gun Course, Part I.

The instructor will explain that the object of the exercise is to train men to turn the wheel so that the line of sight is displaced up or down fifteen minutes for every turn, which will ensure the overlapping of beaten zones at all ranges.

The following points will then be explained:—

i. The wheel will be manipulated with the right hand only.

ii. The wheel must be grasped firmly and turned boldly—not hesitatingly.

iii. Eyes must be directed at the target whilst the wheel is turned.

NOTE.—Whilst learning the men should be allowed to look along the sights, so that they may realise how much the wheel ought to be moved.

Between each turn of the wheel the thumbpiece will be pressed for about four seconds, which is the time required to fire a group of 30 to 40 rounds.

The instructor will give a demonstration, the men afterwards being exercised.

19.—Oblique traversing.

The gun will be mounted 25 yards from the target, as used in the Annual Machine Gun Course, Part I.

The instructor will explain that the object of the exercise is to train men in combining traversing with the manipulation of the elevating wheel.

The following points will then be explained:—

i. The correct sequence of action must be followed, *i.e.*, Fire, tap, elevate (or depress).

ii. The tapping must be automatic as in ordinary traversing.

iii. When elevating or depressing the gun, the sights must be used.

It is apparent that the greater the angle which the line to be traversed makes with the horizontal the greater will be the turn necessary to bring the sights on to the mark after traversing, and *vice versâ*. The turn in this case must not be confused with the fifteen-minute turn in the previous lesson.

The instructor will give a demonstration, after which all the men will be exercised.

20.—Swinging traverse.

The gun will be mounted 25 yards from the target, as used in the Annual Machine Gun Course, Part I.

The instructor will explain that this method of traversing is only employed against linear targets at very close ranges, when the normal method of traversing is likely to prove too slow.

The following points will then be explained:—

i. A certain amount of "stickiness" is advisable from the point of view of control, the vibration of the gun rendering it easy to swing.

ii. The gun must not be moved by a movement of the forearms only. The upper part of the body should be fairly rigid, and the gun should be moved by forcing the upper part of the body over to the opposite side to which it is desired to traverse.

iii. The rate of movement should be such that the line of sight is moved about 1 yard in 2 seconds, when the target is 25 yards from the gun. The movement of the gun is almost imperceptible.

iv. The thumbpiece should be pressed at the same time as the gun begins to move.

The instructor will give a demonstration, after which all the detachment will be exercised. The importance of the cross-head being upright must be emphasised.

21.—Mounting and dismounting the gun in the lowest position.

When the men have made sufficient progress in the previous lessons, they will be taught how to bring the gun into action with the tripod mounted in the lowest position.

The system of instruction will be as described in all the earlier lessons.

It will be explained that the low position may be necessary when only low cover, or none at all, is available.

The instruction will be divided into three stages.

1st Stage.

When, before beginning, the tripod is folded in the usual way, *i.e.*, the rear leg set at a suitable angle for the normal sitting position.

On the command "Mount Gun," No. 1 will carry the tripod to the position indicated, place it on the ground, lie down on the left of the tripod, and loosen all three jamming handles. He will then open the two short legs, raise the socket about one inch from the ground, and keeping it upright, will clamp all three legs, clamping the rear one first. He will remove the elevating and cross-head joint pins.

No. 2 will open the sliding shutter, carry the gun to the position in the usual way, but just before lying down will place the right arm under, instead of over, the barrel casing. He will then lie down and, assisted by No. 1, will place the gun on the tripod. (Plate .)

No. 1 will put in the cross-head joint pin. No. 2 will put in the elevating joint pin, and pull out the cork plug. No. 3 will bring up the belt box in the usual way.

When the gun is mounted No. 1 will lie with both legs on the left of the tripod, right leg crossed over left, his back being supported by the right thigh of No. 2, and his neck being supported by the left knee of No. 2. (Plate .) The gun will be laid with the aperture sight when "in action" in this position.

When, the gun is mounted the usual points will be criticised, and, in addition, note should be taken that the shoes of the tripod and not the tubular portions of the legs are resting on the ground, and that the jamming handle of the rear leg does not interfere with the elevating wheel.

The gun will be dismounted in the usual way except that all movements prior to carrying the gun and tripod to the original position will be carried out in the prone position.

2nd Stage.

When, before beginning, the rear leg of the tripod is set and clamped at an angle suitable for the lowest position.

The instruction will follow the same lines as in the first stage. It will not be necessary to loosen the jamming handle of the rear leg on reaching the position.

3rd Stage.

When, before beginning, the rear leg of the tripod is set at an angle suitable for the prone position, and when, in addition, the two front legs, instead of being folded alongside the rear one, are swung forward and upward, pointing in the air.

The instruction will follow the same lines as in the second stage.

4th Stage.—Use of the auxiliary mounting.

The instructor will explain that the auxiliary mounting is only intended to be used in an emergency, when the Mark IV tripod for some reason is not available, and that the gun can be mounted on the Mark IV tripod without removing the auxiliary mounting.

The gun can be carried by either one or two men, as desired.

i. When carried by one man, the gun will be carried vertically on the right-hand side, muzzle upwards, the right hand grasping the rear leather band, back of the hand to the front, and taking all the weight; the left-hand steadying the muzzle end by means of the light mounting clip.

ii. When carried by two men, the leather straps one on the rear crosspiece, and one on the front clip band, enable Nos. 1 and 2 to carry the gun between them.

When mounting the gun with the auxilliary mounting No. 1 will turn the gun on its left side, and No. 2 will open the tripod legs.

When the gun is mounted, the position of Nos. 1 and 2 will be the same as in the previous stages. (Plate .)

TESTS OF ELEMENTARY TRAINING.

1. The following tests of elementary training have been devised to assist officers in testing the efficiency of their men in elementary training, and also to ensure that no detail of such training is overlooked. It is important that these tests should not be considered as competitions against time, for although quickness is necessary, accuracy is the first essential. No man should, therefore, be passed as efficient unless all the points are properly fulfilled, even though he may complete them in the standard time. Neither should a man necessarily be failed if he slightly exceeds the standard time. The nature of tests vii, viii, and ix renders it inadvisable to lay down a standard time.

2. The tests must be carried out in strict accordance with the detailed instructions given, for unless the smallest details are insisted upon, the time limit will not be applicable. In carrying out these tests, time can be saved if the first pair complete tests 1 to 5 consecutively; the remainder can be carried out as convenient.

3. The entire personnel of a machine gun platoon, including the drivers when possible, should qualify in these tests, acting both as No. 1 and No. 2. This is necessary, for on service any member of a platoon may be required to replace a casualty at a moment's notice. In all tests No. 1 will repeat all orders received. The No. 1 should not be failed when, owing to the fault of No. 2, the time limit is exceeded. He must be tested again with a fresh No. 2.

4. No man will fire the Machine Gun Course until he has correctly passed these tests of elementary training. A record of these tests will be kept by each section commander and produced for inspection by the platoon commander as required.

i. To erect the tripod and mount the gun on the command "Mount Gun."

Nos. 1, 2 and 3 will take post, lying down if the ground permits. The position where the gun is to be mounted to be not more than 5 yards away.

Points to be observed.—All the points given in Sec. — —.

Standard time: 20 seconds.

ii. To load the gun on the command "Load."

Belt with a few dummy rounds at the end, properly packed in the box, which will be closed and fastened.

Points to be observed.—The gun to be correctly loaded; all loading motions to be quite distinct and correct, and to be carried out without any slurring.

Standard time: 5 seconds.

iii. To unload the gun on the command "Unload."

Points to be observed.—Gun unloaded, tangent sight lowered, unloading motions to be quite distinct, belt withdrawn and repacked carefully in the box with lid closed and fastened; lock spring released.

Standard time: 5 seconds.

iv. To dismount the gun on the command "Dismount Gun."

The gun will be dismounted and, together with the tripod and ammunition box, will be placed in the same position as at the beginning of Test 1.

Points to be observed.—All the points as when "All correct" is reported before mounting gun.

Standard time: 15 seconds

v. To bring the gun into action on the command "Action."

This test combines (i) and (ii) It should therefore not be applied until proficiency has been attained in each of those tests.

Points to be observed.—All points as laid down for tests (i) and (ii). When No. 1 is ready to receive fire orders No. 2 will hold up his hand.

Standard time: 25 seconds. The time will be taken from the command "Action" until No. 2 raises his hand, indicating that the gun is loaded.

vi. To adjust the sights and lay the gun on the command "(Range)—(Target)."

Gun loaded and ready to be laid. Three service targets will first be pointed out, but the No. 1 being tested will not know which is to be given. Any range may be ordered, so long as it will not be necessary to alter the slide by more than 500 yards when adjusting for the range ordered. Before beginning, the tangent sight slide will be set at 1,000.

Points to be observed.—That the slide is adjusted and the gun laid with absolute accuracy. When the instructor is checking the aim No. 1 must maintain his "holding" pressure on the handles. No. 1 must be careful, however, that he does not exert lateral pressure when leaning to one side to clear the sights.

Standard time: 12 seconds

The time will be taken from the range being ordered until No. 2 holds up his hand, indicating that No. 1 is ready to open fire.

vii. Horizontal traversing. On the command "Fire," *e.g.*, "450—Horizontal row—From left bull's-eye—To fifth bull's-eye from left—Traversing Fire."

The target will be as for the Machine Gun Course, Part I, placed at 25 yards from the gun. The gun will be laid on any bull's-eye that may be ordered. The tangent sight will be raised, but the firer must keep his eyes directed at the target during the traverse. The tests will comprise traversing from RIGHT to LEFT, as well as from LEFT to RIGHT. When the gun is laid, the aim should be checked by the officer conducting the test. On the command

"Fire," No. 1 will fire a group at the bull's-eye named, then traverse, so that the next group will be fired at the next bull's-eye, and so on. The test will not be completed until the space between nine bull's-eyes has been traversed. In order to ensure that the traversing is satisfactory throughout, the order to cease fire will be given at least once during the traverse, but not before five groups have been fired, and the laying will be checked; this will be repeated when the limit of the traverse is reached.

Points to be observed.—That No. 1 tested his tap before beginning the test; the object is to test if No. 1 has acquired the correct automatic tap. Tapping backwards to correct errors will not be allowed. By counting the number of taps, the correct point of aim can be calculated.

viii. Searching. On the command "Fire," *e.g.*, "450—Right vertical row—Form bottom bull's-eye—To top bull's-eye—Searching—Fire.

The target will be as for the Machine Gun Course, Part I, placed at 25 yards from the gun.

The procedure will be as for (vii) "Searching" being substituted for "Traversing." The tests will comprise searching up and searching down.

Points to be observed.—The object is to test if No. 1 has acquired the correct automatic turn of the wheel. Turning the wheel backwards, to correct errors, will not be allowed. By counting the number of turns, the correct point of aim can be calculated as in (vii.).

ix. Oblique traversing. On the command "Fire," *e. g.*, "450—Oblique row—Left bull's eye—To fifth bull's-eye from left—Traversing—Fire."

The target will be as for the Machine Gun Course, Part I, placed at 25 yards from the gun.

The procedure will be as for (vii) but in this test manipulation of the elevating wheel is included and the firer is allowed to look along his sights. The tests will comprise traversing from RIGHT to LEFT, as well as from LEFT to RIGHT.

Points to be observed.—As in test (vii).

x. Immediate action.

In this test the man will be required to rectify correctly each of four different stoppages within a certain time. The officer superintending the test must ensure that the immediate action is correctly performed without any unnecessary delay.

A target should be indicated to the whole squad previous to the test. The crank handle should be covered with a cloth to conceal its position. On the removal of the cloth for covering the crank handle, the No. 1 will perform the immediate action.

Time will be taken from the moment the cloth is removed to the moment that the thumbpiece is pressed for re-opening fire. The immediate action must be correctly performed and the gun accurately relaid. The order in which stoppages are set up should be varied.

xi. Belt filling.

A heap of 25 rounds of ball ammunition will be placed beside a man and these will be inserted in a belt.

Standard time: 1 minute.

Points to be observed.—Rounds to be placed in a heap and *not* arranged. Inspection of the belt on completion will show if it has been filled correctly.

ADVANCED GUN DRILL.

1. Advanced gun drill consists of :—

i. Drill over rough ground.

ii. Elementary tactical drill.

Drill over rough ground.

2. The object of this drill is to train the detachment in bringing the gun into action on rough ground. Practice will be given in mounting the gun on a steep slope, firing in any of the following directions :—

i. To the front or rear.

ii. To the right or left.

iii. Up hill.

iv. Down hill.

The drill should be taught individually by the instructor.

The kit required is the same as for elementary gun drill, except that a landscape target is not required.

The instruction will be divided into two stages as follows :—

3. *1st Stage.*

In this stage no targets are indicated, and the use of cover is not practised.

The instructor will show how the tripod is erected for all kinds of slopes and he will point out that :—

i. The rear leg must always point down the slope.

ii. The socket must be upright.

iii. Only the shoes of the tripod must touch the ground.

Each member of the detachment will then be exercised in erecting the tripod on a different position.

The instructor will then demonstrate the duties of No. 2 by mounting the gun on the tripod so as to fire in the required direction. He will also demonstrate the use of the belt box carrier, and other means of placing the belt box so as to ensure a correct feed.

Each member of the detachment will then be exercised in mounting the gun on the tripod to fire in different directions. (Plates and .)

NOTE.—It is often more convenient after the tripod has been erected, but before the crosshead is swung round in the direction of the target, to have the gun mounted, and *then* swung round. By doing this, the task of No. 2 is easier than when the gun is mounted *after* the crosshead has been turned.

4. *2nd Stage.*

In this stage an arc of fire will be given, the front indicated, and full use made of cover. No attempt should be made to introduce tactical lessons.

Nos. 1, 2, 3 and 4, with the gun, tripod, etc., will be in a position of readiness, not more than 10 yards from the selected gun position. The remaining numbers will be sent out as observers in the direction of the front, and will criticise the movements of Nos. 1 and 2 as regards exposure when coming into action.

The instructor will mark a gun position, give the arc of fire, indicate the front, and then order "Action."

5. The following points should be criticised after No. 2 has raised his hand to indicate that the gun is in action :—

i. Whether there was any unnecessary exposure whilst the gun was being brought into action.

ii. Whether the gun is properly in action, and all the details of elementary training have been observed.

iii. Whether the fire would clear any existing obstruction

iv. The correct erection of the tripod, with the rear leg down hill.

v. Whether the tripod, had to be altered after the gun was mounted.

vi. The positions adopted by Nos. 1 and 2 as regards exposure and comfort.

vii. The position of the belt box to ensure correct feed.

viii. The position of No. 3 (minimum exposure, within view of the gun and with ease of ammunition supply).

ix. The position of No. 4.

When the men have made sufficient progress in the above, they should be practised in arranging and clamping, under cover, the position of all three legs (before mounting), so that the socket will be upright when the tripod is mounted on the position indicated.

ELEMENTARY TACTICAL DRILL.

6. Before this drill is carried out the following should have been given :—

i. A short lecture on the characteristics of the machine gun.

ii. A demonstration in the use of cover from view, both natural and artificial, followed by practice in concealing gun positions.

iii. A short lecture on reconnaissance, especially with reference to the selection of gun positions.

These exercises form a link between rough ground drill and the tactical handling of machine guns in the field. If the exercises are carefully prepared and executed, the section officer on service will be relieved from the necessity of supervising the detailed execution of his orders, and will be left free to devote his attention to the general situation, while retaining control of the movements and action of his guns.

The exercises should be carried out on the lines of the following example.

7.—Exercise with one gun.

The exercise is designed to give practice to gun numbers in the following :—

i. Reconnaissance

ii. The use of cover in :—

(*a*) The approach to the gun position.

(*b*) The gun position itself.

iii. The method of approach to the gun position as regards the carrying of the gun, tripod, etc. Concealment will be considered of greater importance than rapidity, within reasonable limits.

iv. Provision of a chain of supply under cover.

v. Proficiency in rough ground drill.

The kit required is the same as for rough ground drill, but four belt boxes should be provided in order that ammunition supply may be practised.

8. *Preliminary arrangements.*

The value of the exercise will depend upon the suitability of the ground selected. The ground should permit of the following :—

i. A frontage of about 50 yards, containing only one suitable gun position, under cover, from which the arc of fire is visible.
ii. A position of readiness about 50 yards in rear of the gun position.
iii. A covered line of approach.
iv. A position about 100 yards to a flank from which the arc of fire is visible.

The target must be of a service character, and have a different aspect from positions (i) and (iv). It should be reasonably difficult to recognise from the gun position.

9. *The exercise will be carried out as follows :—*

i. Explain the objects of the exercise to the section.
ii. March the section to the position of readiness.
iii. Detail Nos. 1, 2, 3 and 4 to each of the four guns.
iv. Detail an officer or N. C. O. to accompany each team and to note criticisms on the actions of the various gun numbers.
v. Define the limits within which the detachments may manœuvre.
vi. Order Nos. 2, 3 and 4 to remain at the position of readiness, and march the remainder, including Nos. 1, to position described in paragraph 8 (iv) above.
vii. Call up Nos. 1, give the front, indicate the arc of fire, and order them to return to the position of readiness and await orders.
viii. Signal "Action" to the first gun detachment. Observers should be sent out to note the visibility of the gun and detachment in approach, in mounting, and in action. The remainder of the section should follow and criticise the gun detachments from a flank.
ix. After the gun is in action, the supervising officer will call for criticisms, in turn, from the observers, the remainder of the section, and the officer or N. C. O. detailed to accompany the detachment.

10. *Points for criticism.*

i. Whether No. 1 before starting gave the remainder of the detachment the arc of fire and a full description of the front, so that the guns might still be brought into action correctly should he become a casualty.
ii. Whether No. 1 made a careful reconnaissance, keeping under cover, and selected the position from which the arc of fire is visible.
iii. Whether No. 1 indicated the front and arc of fire to the remainder of the team from a position under cover (but not at the gun position) if this was possible.
iv. The actions and positions of the other numbers, especially as regards the use of cover and the chain of supply.
v. Whether all the points of elementary training and rough ground drill were correctly carried out.

The same procedure will be carried out with each detachment of the section in turn. Occasionally the No. 1 should be made a casualty during his advance to the gun position.

This stage should be practised subsequently over different ground, and the gun numbers changed round.

ELEMENTARY SECTION DRILL.

1. Elementary section drill consists of :—

i. Section gun drill.
ii. Limber drill.
iii. Pack saddlery drill.

Instructions in machine gun signals (Sec.—) will be given before elementary section drill is carried out, and these signals should henceforth be used whenever possible.

Elementary section drill is carried out with four guns, *i.e.*, the section. An officer will control the drill, and a N. C. O. will supervise each gun detachment. The N. C. O. will take times and carefully note the performance of each detail; he will not assist the gun detachment, nor give any instructions unless so ordered. When the state of the ground permits, all numbers should lie down, Nos. 3 and 4 forming a short chain of supply, and the remainder continuing the chain or representing reserves to replace casualties.

2. The purpose of elementary section drill is to increase proficiency in advanced gun drill, to accustom the various numbers to work as a section, and to provide practical instruction in the following subjects :—

i. The delivery and execution of fire orders. This opportunity should be taken of practising officers and non-commissioned officers in fire control.
ii. Immediate action.
iii. The replacement of casualties and breakages.
iv. The supply of ammunition, oil and water.
v. The various drill movements for carrying out indirect fire.
vi. Limber drill and pack saddlery drill.

Section gun drill. (*Stages 1 to 5.*)

3.—Kit required for each gun detachment.

Gun fitted with auxiliary mounting and with the barrel casing filled, tripod, two felt boxes and belts with dummies, spare parts box complete, condenser tube* fitted to gun, condenser bag half filled with water, and landscape target.

* NOTE.—On all occasions during training, except when firing, a dummy condenser tube should be used to prevent the metallic tube from being damaged. The dummy tube can be made by attaching a union joint to a 6ft. length of half-inch rope.

4. Section gun drill will be taught in seven stages.

First Stage.

The detachment will be exercised in all the movements of elementary drill up to and including "Action" and "Out of action," in both the normal and lowest positions. Practice in the use of the auxiliary mounting will also be given. Fire orders should be simple, and alterations in sighting elevation and targets should be practised.

Second stage.

In addition to the points mentioned in the first stage, the fire orders should include the use of traversing, searching and combined sights (Sec. —). Also the fitting of the condenser tube and bag.

Third Stage.

Before this stage is carried out, immediate action and repairs and adjustments must have been practised in the mechanical training on the gun.

In this stage service targets in the open country will be used.

In addition to the points mentioned in the previous stages practice should be given in:—

Immediate action.

Replacing casualties and breakages.

Ammunition, oil, and water supply.

Fourth Stage.

As for previous stages, but introducing the issue, carrying out and passing of fire orders.

Fifth Stage.

As for previous stages, but introducing safety methods both lateral and vertical for direct overhead fire, *viz.*, graticule and tangent sight methods.

Sixth and Seventh Stages.

5. In order that a section may work in the field with officiency the methods of indirect fire must be learnt as a drill. This will enable the personnel in action to reproduce automatically the movements learned in practice, with such modifications as the conditions of battle may impose.

6.—Kit required for each gun detachment.

Gun and tripod.

Bar foresight.

Belt boxes (4), belts, and dummies.

Condenser tube and bag.

Clinometer.

Cleaning rod.

Spare barrel and spare parts box.

Two posts—the "zero post" and the "target post."

Guns and tripods will be laid out as in elementary gun drill. A gun commander will be appointed for each gun.

Sixth Stage.

As for the first three stages, but introducing the laying of guns on parallel lines preparatory to using indirect fire.

7.—"Fall in."

Detachments will fall in in line as in elementary gun drill, gun commanders on the right of Nos. 1.

Section commander will indicate the reference object (if one is being employed).

8.—"Number."

As in elementary gun drill.

9.—"Take post."

As in elementary gun drill. No. 3 has with him a condenser bag, four belt boxes, and the posts. No. 4 has the spare barrel and spare parts box. The gun commander takes post on the left of No. 1, and has the cleaning rod, clinometer, and bar foresight.

10.—"Tell off by guns."

The gun commanders number off from the right: "No. 1 gun," etc.

11.—"Prepare for action."

No. 1 examines the tripod, and No. 2 prepares the gun (condenser tube fixed) for action. No. 3 inspects the ammunition. Nos. 5 to 8 are spare men, and remain under cover.

12. The section must now be laid on parallel zero lines. All methods of doing this should be practised. When a reference object is used in front of or behind the section, the drill will be as follows:—

i. "*Flank guns—Mount gun.*"—The flank guns are mounted and laid on each other. No. 2 of each gun notes the reading on the direction dial and signals with his hand to the other No. 2 when this is done. Both guns now lay on the reference object, and the angle swung through is noted. These angles are passed along to the section commander, who then calculates the distribution angle to obtain parallel lines.

ii. "*Remainder—Mount gun.*"—The remaining guns are mounted and laid on the reference object. No. 3 of each gun brings up two belt boxes and the condenser bag. Nos. 2 and 3 ensure the firm bedding of the tripod legs. No. 2 places the condenser tube inside the bag. The gun commander fits the bar foresight on to the gun.

iii. The angle of distribution from the reference object necessary to bring all guns on to parallel lines, followed by the angle of switch from the reference object necessary to bring all guns on to parallel zero lines, will now be passed to each gun commander, either verbally (para. 21) or in writing.

The angle of distribution will be laid off by means of the bar foresight and the angle of switch by the direction dial.

iv. When the gun has been laid on its parallel zero line, the gun commander will adjust the bar foresight to zero. No. 3 will then pace out 10 yards from the crosshead and drive in the zero post. In this he will be directed by No. 1, who will adjust the tangent sight slide to bring the line of sight on to the post.

The zero post will not be moved once the gun has been laid on its parallel zero line.

13.—"Stand clear."

The detachments will fall in 5 yards in rear of the guns and stand at ease.

Seventh Stage.

As for sixth stage, but introducing the issue, carrying out and passing of fire orders for indirect fire.

14.—"Stand to."

All numbers take up their positions. The gun commander kneels down with the cleaning rod and clinometer on the left of No. 1.

Orders for change of direction from the zero line (if necessary) to engage the first target, followed by the elevation, will be given verbally or in writing.

Whenever possible these and subsequent orders for changes of direction and elevation should be given in writing in the form of a gun chart.

When the angle of deviation from the zero line does not exceed 7 degrees it can be laid off from the zero post by means of the bar foresight, in which case there will be no need to place out the target post.

The gun commander will place the elevation on the gun by means of the clinometer.

When direction and elevation have been placed on the gun, the gun commander will report "No. 1 gun ready," etc.

15.—"Load."

As in elementary gun drill.

16.—"Traverse."

Will be 2 degrees, *i.e.*, 1 degree right and 1 degree left, unless otherwise ordered.

17.—Rate of fire.

Slow, medium, or rapid.

18.—"Fire."

Bursts of fire should not be less than 50 rounds. No. 1 re-lays between bursts, and traverses between bursts. *Accuracy in re-laying must always be insisted on.*

19.—"Cease fire."

Procedure after first lift or first belt, whichever is the shorter :—

No. 1 unloads and clears gun.

No. 2 removes the outer casing, tests the muzzle cup, cleans the barrel and replaces the outer casing.

No. 3 brings up ammunition.

No. 1 oils up, reloads, and lays for direction.

Gun commander puts on elevation.

No. 2 signals "Ready to fire."

Procedure after every 1,000 rounds :—

No. 1 unloads and clears gun.

No. 2 cleans the barrel and replenishes the water in the barrel casing, if necessary.

No. 3 brings up ammunition.

No. 1 oils up, reloads, and lays for direction.

Gun commander puts on elevation.

No. 2 signals "Ready to fire."

20.—"Unload."

As in elementary gun drill. The gun commanders report "No. 1 gun clear," "No. 2 gun clear," and so on.

21.—"Out of action."

The guns will be dismounted at the firing point.

22.—Sections should be practised in coming into action in different positions, obtaining parallel lines by different methods, and firing by charts. In the latter case, verbal orders should be dispensed with as far as possible.

In the final stages of training, section commanders should be practised in applying the fire of their sections to any target with rapidity and accuracy. Throughout the drill, gun numbers must be changed round frequently.

23.—Practice with ball ammunition should be carried out on a short range.

A method of preparing targets for use in this case is as follows :—

i. Work out the angles of direction and elevation required for each task.

ii. Place each gun about 25 yards from a 6-foot white screen. Lay for each task, look along the barrel and note at what points on the target the bullets should strike. Mark these points and the limits of traverse on each target. Sketch in machine gun targets on a scale suited to the distance, *viz.*, 25 yards.

iii. If the exercise be carried out by day a screen should be erected between the gun and target.

Attention must be paid throughout to all points of elementary training and drill.

24.—Examples of verbal orders.

Either of the flank guns may be the directing gun. In the following examples the left gun is taken as the directing gun.

(*a*) DISTRIBUTION.

i. To obtain parallel lines.

"Distribute 20 minutes."—This is the angle obtained by the section commander in paragraph 12. The angle 20 minutes has been used simply for the purpose of illustration. The same applies to all other angles. This order will be passed down as follows :—

The gun commander of No. 4 gun repeats the order and the laying of No. 4 gun is not altered.

The gun commander of No. 3 gun repeats "20 minutes right—Distribute 20 minutes," and No. 3 gun is laid off 20 minutes to the right of the reference object by means of the bar foresight.

The gun commander of No. 2 gun repeats "40 minutes right—Distribute 20 minutes," and the gun is laid off 40 minutes to the right of the reference object by means of the bar foresight.

The procedure for the other gun is similar to the above.

The guns are now laid on parallel lines and can be swung on to their zero lines as follows :—

"All guns—Degrees right (or left)."

Each gun commander repeats the order and the gun is laid off the given angle from the reference object on the direction dial.

The guns are now laid on parallel zero lines.

ii. To engage a target.

"All guns on zero lines."

The gun commander repeats the order. No. 1 lays on the zero post.

"All guns—Degrees right (or left)."

The gun commander repeats the order. No. 1 lays off the given angle on the direction dial. No. 3 paces out 10 yards from the crosshead and, directed by No. 1, drives in the target post.

"Distribute 20 minutes."

The procedure is the same as in (i) except that the target post is here used instead of the reference object.

(*b*) ELEVATION.

i. **"Elevation 3 degrees."**

Each gun commander repeats the order and lays the gun to that elevation with the clinometer. No. 1 adjusts the tangent sight slide to bring the line of sight on the target post and notes the reading on the sight.

ii. **"Elevation 4 degrees—Add 20 minutes."**

The gun commander of No. 4 gun repeats the order and lays the gun to 4 degrees with the clinometer. No. 1 proceeds as in (i).

The gun commander of No. 3 gun repeats "Elevation 4 degrees 20 minutes—add 20 minutes," and lays the gun to 4 degrees 20 minutes with the clinometer. No. 1 proceeds as in (i).

The procedure for the other guns is similar to the above.

iii. **"Elevation 5 degrees—less 10 minutes."**

The gun commander of No. 4 gun repeats the order and lays the gun to 5 degrees with the clinometer. No. 1 proceeds as in (i.).

The gun commander of No. 3 gun repeats "Elevation 4 degrees 50 minutes—Less 10 minutes," and lays the gun to 4 degrees 50 minutes with the clinometer. No. 1 proceeds as in (i).

The procedure for the other guns is similar to the above.

ADVANCED SECTION DRILL.

1. The object of advanced section drill is to practise the section in carrying out, in combination, the various forms of drill already taught in elementary section drill, and in applying drill to suit all forms of ground. All ranks must be exercised in their respective duties. For this purpose, all movements, dispositions, etc., must be made with reference to some tactical situation explained beforehand by the section commander. The situation must be such as will necessitate the employment of scouts and rangetakers in a realistic manner. Ranges will actually be taken. Ammunition supply will be carried out, empty boxes being passed back for refilling. The replacement of casualties and breakages will be practised, but must not be carried to an extreme. The points to be attended to in elementary section drill must be carefully observed.

As proficiency increases, practice should be given in situations which require rapid action, such as changes of targets and of gun positions to meet surprise situations.

The drill should be carried out in stages or lessons, as shown below.

2. *First Stage.*

To teach the selection of gun positions with reference to :—

i. Ability to fire within the arc of fire ordered.
ii. Communication with the O. P.
iii. Ammunition supply.

In this lesson limbers will not be used, but the section should be drawn up in a position of readiness at least 300 yards from the ground on which the guns will come into action. The ground selected should be suitable for inculcating the lessons to be learnt in the reconnaissance and selection of gun positions (see section—) and in the use of ground (see section—).

The frontage should be at least 200 yards wide, and should contain more than one possible gun position.

3. *Second Stage.*

As for first stage, but introducing action from limbers.

This will entail attention to the following points :—

i. Drill must not be divorced from tactics. After the gun position has been selected and the order has been given to bring up the guns, application of drill is required in getting the guns into action. The danger of the detachments bunching together when advancing from the limbers to the gun position must be avoided.

ii. Broadly speaking, except in the case of a fleeting target, when it will be expedient to open fire at once with the first gun to get into action, a section commander will wait till all his guns (or at any rate three of them) are ready to open fire before he gives the signal to do so. A systematic arrival of the various numbers at the gun position should be aimed at. Undue haste, which will only lead to confusion, should be avoided. Detachments must be well under control when going into action, and such control should be exercised by the N. C. O. at the limbers. There is need for quick action, but it must not be allowed to degenerate into a scurry, and there should be no shouting.

iii. Generally speaking, crawling should be confined to movement over the last few yards in approaching a position. When longer distances must be covered, in possible view of the enemy, it is better to make a bold dash right up to the gun position, stimulating the movement of infantry as much as possible.

iv. *Protection.*—The principle that every unit is responsible for its own protection must be impressed upon all ranks, and practice must be given in the methods of protection to be employed. The measures against surprise which have been taken when the guns are on the move must not be relaxed when the guns are in action. Protection of the flanks is of special importance, and a sentry must always be posted to watch any locality from which the gun position may be turned.

4. *Third Stage.*

As for previous stages, but introducing changing from limbers to pack and coming into action from the latter.

NOTE.—The ground selected should, if possible, be such as to necessitate this change.

5. *Fourth Stage.*

As for the second stage, but introducing a forward movement of the section, on limbers, to another position.

Use of limbers.—The fullest possible use should be made of limbers for the rapid conveyance of guns and men.

Where the line of approach is concealed from the enemy, limbers should be brought up as close as possible in the first instance. But as soon as the limbers have been unloaded they should be sent back to a suitable position far enough away to avoid shell-fire directed at the guns. On the other hand, if safe cover (such as a quarry or very steep slope) exists close behind the gun position the limbers may remain there.

In a situation where it is absolutely essential to get into action without a moment's delay, and where the nature of the ground permits of no alternative, limbers should be driven boldly up to the gun position, quickly unloaded, and as quickly driven away to suitable cover.

Limbers must not bunch together. They should be kept at least 40 yards apart whenever they are on ground which may be subjected to hostile fire. Touch must be kept between the limbers and the guns when the latter are in action.

6. *Fifth Stage.*

As for the fourth stage, but with the forward movement carried out on pack. (See note to third stage.)

7. *Sixth Stage.*

As for fourth stage, but applied to suit indirect fire positions.

8. *Seventh Stage.*

As for sixth stage, but introducing selection of gun positions by gun commanders to ensure clearance of the immediate obstruction in accordance with instructions received regarding lowest elevation to be used and limits of arc of fire.

9. After the section has attained proficiency in each of the above stages, it should be practised in carrying out elementary tactical exercises framed so as to bring out all the lessons to be learnt in several of the above stages, and carried out on different areas of ground.

It will be of great advantage if these exercises can be carried out in co-operation with infantry.

Before each exercise is begun the section officer will explain its purpose and the principles that will be followed in carrying it out, and, on its conclusion, detailed criticism will be made.

In this way the rank and file should gradually be trained in elementary tactical principles, and their initiative encouraged and developed along sound lines. In these exercises, in addition to all the points mentioned previously, particular attention should be paid to :—

i. Formations to be adopted in battle. (Infantry Training, Vol. —, Chapter —, Section —.)

ii. Inter-communication, both by signal and runner.

SGPI—129CGS—10-2-21—1,500.

Extract from Equipment Regulations, India, Part I 1923.

189. The following table shews the distribution. carriage, etc., of all barrels provided for Vickers, Lewis and Hotchkiss machine guns:-

Extract from Equipment Regulations, India, Part I 1923.

189. The following table shews the distribution. carriage, etc., of all barrels provided for Vickers, Lewis and Hotchkiss machine guns:-

	NUMBER OF BARRELS PER GUN.			
	Field Army and covering Force Units.		All other Units.	
	Peace	War	Peace	War.
1	2	3	4	5
Lewis				
In the gun	1	1	1	1
In unit charge (spare)	2(a)	1	2(a)	1
In ordnance reserve	2	2	2	2
Hotchkiss.				
In the gun	1	1	1	1
In unit charge (spare)	3(a)	1	3(a)	1
In ordnance reserve	2	2	2	2
Vickers.				
In the gun	1	1	1	1
In unit charge (spare)	2(a)	1	2(a)	1
In ordnance reserve	2	2	1	1

(a) 1 carried in spare barrel case, balance kept in store.

2. The two spare barrels for Vickers and Lewis guns and 2 of the 3 for Hotchkiss guns in unit charge (columns 2 and 4) are mobilization equipment and must not be used in peace.

3. When orders to move on mobilization are received, the worn barrel in the case of Vickers and Lewis guns and the two worn barrels in the case of Hotchkiss guns will be returned to ordnance charge. The barrel removed from the gun being replaced by one of the spare barrels in possession.

SUMMARY OF LECTURES

J. Russell

DELIVERED AT

The Machine Gun School

ENGLAND

1920

Reprinted in India and Issued by the General Staff India.

CALCUTTA
SUPERINTENDENT GOVERNMENT PRINTING, INDIA
1922

A.O.292. 1922. Instructions for Armourers, &c., 1912 (reprint, 1916) — Amendment. — *For* instructions under "BROWNING MIXTURE" on pages 35, 36 and 37, *substitute*—

A.O. 292. 1922.

BROWNING MIXTURE.

Process to be followed by armourers in regimental shops and R.A.O.C. workshops where without sand blast.

The following quantity is sufficient for 50 rifles. One-third of this quantity will be sufficient for 50 bayonets and scabbards :—

	ozs.
Rain or soft water	12
Blue stone	$\frac{1}{16}$
Nitric acid	$1\frac{1}{4}$
Tincture of steel	$3\frac{1}{2}$
Spirits of wine	2
Spirits of nitre	3

The above-mentioned ingredients will be mixed by the armourer in the order shown, directly they are received. Os.C. units, &c., will caution armourers against keeping the ingredients packed in separate bottles, as danger from fire is likely to arise from the nitric acid if it is spilt before being mixed with the other ingredients.

If the armourer has a larger quantity of ingredients than he actually requires for the arms he has to brown, he will at once return the surplus to the quartermaster's store.

Ingredients for browning mixture should be measured by fluid measure as follows :—

60 minims = 1 dram.
8 drams = 1 oz.
20 ozs. = 1 pint.

1st Day.

Boil components in strong soda water for ½ hour (1½ lbs. of soda to the gallon of water) to remove the grease. Wipe down with clean wet cloths to remove soda (inside of barrels to be wiped out with rod and wet jute). When barrels and components are cold coat with the mixture rubbing the first coat well in. Stand in a dry place for 3 to 4 hours, then coat cold with mixture again and stand in the drying room for the night.

2nd Day.

Boil components in clean water for 20 minutes and, when cold, scratch off. Coat cold with mixture and stand them in a dry place for 3 to 4 hours. Then coat cold again and stand them in the drying room for the night

3rd Day.

Repeat as 2nd Day.

4th Day.

Boil in clean water for 20 minutes. When cold, scratch off and oil.

NOTE.—For the first coat take 2 ozs. of the mixture and add ¼ oz. of nitric acid. This applies to the first coat only.

SWORD-BAYONETS, AND LOCKETS AND CHAPES OF SWORD-BAYONET SCABBARDS.

Strip the grips, grip screws and nuts, and bolts, nuts and springs from the sword-bayonets, and the lockets and chapes from the scabbards. Continue with the browning process as laid down for rifle components.

NOTE.—In all cases where the instructions are to bolt sword-bayonets, the whole and not only the pair coated with browning mixture is to be submerged. This will prevent the blade from rusting in the process. The underside and ends of the grips of sword-bayonets should be coated with mineral jelly before assembling.

A.O. 292 1922 *continued.*

After browning, the interior of lockets and chapes will be wiped clean and oiled to prevent the formation of rust, and the springs of the locket also will be oiled. On re-assembling to the scabbard, the oil will be removed to permit of the proper fixing of the glue.

LECTURES.

		Pages.
I.	The Characteristics of the Machine Gun	1
II.	Machine Gun Tactics. "Reconnaissance"	3
III.	Machine Gun Tactics. "General Principles"	5
IV.	Machine Gun Tactics. The Advanced Guard and the Attack	9
V.	Machine Guns (1) In the Defence	13
	Machine Guns (2) With a Rearguard	16
VI.	Indication and Recognition of Aiming Marks and Judging Distance by the Machine Gunner	17
VII.	Fire Orders	19
VIII.	Cover	21
IX.	Machine Gun Limbers and Pack	23
X.	Care of Machine Guns and Mountings	25
XI.	Testing Barrels for Accuracy	27
XII.	Fire Direction	33
XIII.	Climatic Allowances	35
XIV.	Application of Fire	41
XV.	Traversing—Combined Sights—Searching	43
XVI.	Observation of Machine Gun Fire	45
XVII.	Covering Fire	49
XVIII.	Indirect Fire	51
XIX.	Indirect Fire, T. O. G. Method (Short Base)	53
XX.	Indirect Fire, T. O. G. Method (Long Base)	55
XXI.	Indirect Fire, Map Methods	57
XXII.	Indirect Covering Fire	59
XXIII.	Section Control I (Indirect Fire)	61
XXIV.	Section Control II (Indirect Fire)	63
XXV.	Night Firing	65-67

LECTURE I.

"THE CHARACTERISTICS OF THE MACHINE GUN."

1. *General.*—The tactical handling of the Machine Gun is based on its characteristics.

2. *Historical.*—The evolution of the Machine Gun in the course of the search for the weapon of greatest fire power :—

Gatling.
Mitrailleuse.
Hotchkiss.
Maxim.
Vickers.

3. *High Fire Power.*

(*a*) Rapidly produced, but time is required to produce effective volume. (*See* Summary "Fire Direction," I.)

(*b*) Can be maintained. One machine gunner has fired 14,000 rounds in one hour.

1. The gun can cope with an urgent situation.
2. Full fire effect can be brought to bear in a short time with considerable shock to the enemy.
3. Releases proportion of riflemen from the defence, thus leaving more available for offence.
4. Provides the key to the attainment of that fire superiority so necessary to a successful offensive.

4. *A Platform* in some respects comparable to that of artillery mountings, *i.e.*, the gun will fire accurately in the direction and for the range it has been laid.

Necessitated by 3 (*a*) and (*b*) above.

(*a*) Elimination of many personal failings, thus rendering the M. G. valuable in a crisis.

(*b*) Peace shooting produced in war.

(*c*) Close grouping of fire.

(*d*) Enables laying to be maintained, thus ensuring safety in firing over other troops and accuracy when firing at night.

(*e*) Accuracy in range-finding, indication, recognition, and aiming necessary.

(*f*) Enfilade fire highly desirable at close and effective ranges.

(*g*) The only small arm weapon capable of producing appreciable fire effect at extreme range.

5. *Fire delivered from a point, c.f. riflemen.*

(*a*) Speed in deployment.

(*b*) Ground and Cover should be used skilfully.

(*c*) Comparative invisibility.

6. *All round traverse.*—Minimum of exposure and loss of time in opening fire in a fresh direction, as far as the ground permits.

7. *Relative mobility.*

(*a*) Less than the mobility of Infantry when man-handled.

(*b*) On pack equally mobile as Infantry.

(*c*) On limbers more mobile than Infantry.

8. *Technical considerations.*

(*a*) Stoppages.

(*b*) Noise of firing.

(*c*) Flash.

(*d*) Steam.

(*e*) Muzzle blast.

By virtue of Paras. 3, 4 and 7, the Machine Gun is a distinctive weapon with tactics of its own.

LECTURE II.

MACHINE GUN TACTICS. "RECONNAISSANCE."

1. Machine Gun Reconnaissance entails the collection of the necessary information concerning the disposition, probable movements of our own and the enemy troops, and the ground over which operations are taking, or may take place. This information may be obtained by :—

(*a*) Personal reconnaissance on the ground or from a distance.

(*b*) Study of available maps, orders, reports, etc.

The latter cannot take the place of personal reconnaissance.

2. The time available will determine the scope of the reconnaissance, its value can be greatly increased if good liaison exists with the Infantry. *In no case, however, must a M. G. Unit be brought into action without preliminary reconnaissance.*

3. Definite instructions are necessary before starting, and care must be taken to reconnoitre in accordance with these instructions.

4. Machine Gun reconnaissance may be considered under three headings :—

(*a*) *General Reconnaissance.*

(1) To ascertain the tactical situation, and the intentions of the Infantry Commander.

(2) To decide on the best method of obtaining liaison at all stages of the fight.

(3) To enable a general plan of machine gun action to be submitted to the Infantry Commander for his consideration and approval.

(*b*) *Special Reconnaissance.*

(1) To select areas for gun positions, and "Observation Posts," and a "position of readiness."

(2) To find suitable lines of approach for the machine gun unit from the point to which it has already been directed to the "position of readiness."

(3) To enable ranges to be taken, and to ensure that fire direction problems are solved *before* the Unit arrives.

(4) To find positions for the limbers when the guns are in action.

(5) To make arrangements for protection when in action.

(6) To decide on lines of advance or retirement to the next probable fire position.

(*c*) *Detailed Reconnaissance.*

(1) To select actual gun positions and lines of approach from position of readiness.

This reconnaissance is taught during Tactical Drill. (*See* "Machine Gun Training," Chapter VII, Section 36.)

5. Points to be considered when selecting areas for gun positions and observation posts :—

GUNS.

(1) Clear and safe field of fire over the zone to be covered.

(2) Facilities for communication with the observation post.

(3) Concealment of guns from ground and air.

(4) Covered approaches for ammunition supply.

(5) Not likely to be shelled.

OBSERVATION POSTS.

(1) Good view of zone to be covered and our own Infantry.

(2) Enable observation of fire to be carried out.

(3) Covered line of approach.

(4) Facilities for communication with the guns.

(5) Not likely to be shelled.

In selecting observation posts, it will sometimes be found difficult to comply with (2) and (4), unless adequate telephones are available, or the ground allows of observation from a position close to the guns.

LECTURE III.

MACHINE GUN TACTICS. "GENERAL PRINCIPLES."

1. *A Definition of Tactics.*—In War, the struggle for victory is composed of a number of single acts, complete in themselves, which we call battles. The art of conducting the fighting in these battles is called TACTICS, whereas the art of arranging the battles so that they may bring the campaign to a successful issue is called STRATEGY. (Clausewitz, Book II.)

2. *Fire Action gives practical effect to Tactical Dispositions.*—It is impossible to separate fire action from tactics. In the case of machine guns Fire Direction gives practical effect to tactical disposition.

"The term Fire Tactics has been objected to as suggesting a separation of fire action from tactics generally. There is, however, no such separation, and the term is used to describe all methods of fire action by which practical effect is given to tactical dispositions." (Col. McMahon, Chief Instructor, School of Musketry, Hythe, 1906.)

3. *Machine Guns exist solely for the support of the Infantry. This support is given by supplying Covering Fire.*—Whether in attack or defence, machine guns are responsible for covering infantry dispositions and movements, especially at times when other forms of covering fire are weak or non-existent.

The allotment of subsidiary tasks likely to interfere with this rôle must be avoided.

4. *Covering Fire from the various arms compared.*

(*a*) *Artillery.*—The volume and continuity of fire is practically continuous owing to the use of overhead fire. The supply of ammunition becomes a matter of considerable difficulty in mobile fighting. Under these conditions this form of covering fire must of necessity be reserved for targets which cannot be dealt with by other means of fire.

(*b*) *Machine Guns.*—The volume and continuity of fire is practically continuous owing to the use of overhead fire. Owing to limited range as compared to artillery, and to the fact that it can produce only small arm fire, it should be employed on occasions when the opposition met with can be dealt with by this nature of fire. The more mobile the fighting, the greater are the demands, and the greater the possibilities for machine gun covering fire.

(*c*) *Infantry.*—The volume and continuity of fire is constantly checked by movement and the characteristics of the infantry weapons. The accuracy of the fire varies with the personal factor and the varying possibilities of control.

(*d*) *Tanks.*—The volume and continuity of fire is not checked since Tanks move in advance of the Infantry and can fire during movement. This form of covering fire is limited by the number of Tanks and the amount of ammunition each can carry.

(*e*) *Aeroplanes.*—The volume and continuity of fire is constantly checked by speed. Covering fire from Aeroplanes is very limited.

5. *The Smallest Tactical Unit of Machine Guns is the Section of Four Guns.*—Less than four guns cannot give appreciable covering fire, since the "hitting power" becomes too weak. The use of machine guns singly *must* be avoided as this results in dissipation of fire due to lack of control. In highly mobile fighting, when great volume may be required, and when communica ion is difficult, the Platoon of 8 guns will often be used as such. In the attack, in the case of the more forward guns, it may sometimes be necessary to push forward by Sub-sections in order that the principles of fire and movement may be complied with. In the defence it will frequently be necessary to dispose the more forward guns by Sub-sections. Such dispositions must permit of general control by the Section Commander.

6. *Depth is essential in Machine Gun Dispositions whether in Attack or Defence.*—Flexibility of control, reinforcement of the front, and protection of the flanks, are only possible when machine gun units are disposed in depth. Overhead fire facilitates reinforcement of the front, but Machine Guns disposed for this purpose can only afford limited protection to the flanks. Adequate depth for this purpose can only be attained and *maintained* by a suitable "Tactical organisation" which enables machine gun resources to be disposed according to tactical necessity.

7. *Direct Fire is the normal and most effective method of engaging a Target and should be employed whenever possible.*—As, however, cases often occur even during mobile fighting when direct fire is not possible, it follows that machine gun units must be proficient in the use of indirect fire. If training in indirect fire is neglected, machine gun units will be unable to carry out their rôle of *Covering Fire* when direct methods fail.

8. *The Principles of Machine Gun Tactics, based on the characteristics of the weapon, are the same whether the Campaign is large or small.*—The nature of the country in which the fighting takes place, the climate, moral, armament and training of the enemy, decide the proportion of machine gun units to other arms.

9. *The Machine Gun must be regarded as a distinctive weapon with tactics of its own which are neither those of the Infantry nor of the Artillery but intermediate between the two.* (Lessons of the War, 1914-1918.)—The Machine Gun cannot be looked upon as an Infantry weapon in the sense that the rifle, bayonet and Lewis gun are. This is due to the difference in "characteristics." The chief points of difference are :—

(*a*) Comparative immobility when man-handled due to weight and number of loads.

(*b*) Inability to fire when on the move, hence machine gun movements cannot be synchronised with those of Infantry.

(*c*) Owing to water cooling, strength of mechanism and a firm mounting, small arm fire is effective at ranges beyond the power of riflemen, and can be maintained for practically indefinite periods. Overhead fire is not only possible owing to greater accuracy, but is necessary, since it is the only way in which continuity of fire can be obtained with safety to the Infantry.

(*d*) Since overhead fire is the normal method of fire, and in order to ensure that the long and narrow zones at medium and short ranges are used to their best advantage, the dispositions of machine guns will rarely coincide with those of the Infantry whom they are covering.

CONCLUSION.

1. The Tactical rôle of machine guns is to supply covering fire to Infantry dispositions and movements. The full power of Machine Guns must be available when operations are mobile.

2. Volume and control are necessary to Machine Gun covering fire.

3. Volume and control are obtained by a suitable "tactical organisation," and by the employment of machine guns by "sections" or "platoons."

4. Machine Gun dispositions rarely coincide with those of Infantry whom they are covering, and their movements cannot be synchronised with those of the Infantry.

5. Depth in Machine Gun dispositions is essential.

LECTURE IV.

MACHINE GUN TACTICS. "THE ADVANCED GUARD AND THE ATTACK."

THE ADVANCED GUARD.

1. The duties of an advanced guard comprise: (*a*) Reconnaissance. (*b*) Fighting. It will generally be necessary to fight in order to gain information. The development of a considerable volume of fire at very short notice may, therefore, be necessary; hence a large proportion of the available machine guns should be allotted to an advanced guard.

2. Machine gun units should be placed well forward in the order of march so that they may come quickly into action, but if allotted to the vanguard they must be accompanied by a suitable infantry escort to guard against surprise. If allotted to the vanguard machine guns will be required to produce covering fire to assist the infantry in reaching ground from which to complete reconnaissance.

3. The rôle of machine guns acting with an advanced guard will be to provide covering fire to assist the infantry in—

(i) Driving in the enemy's advanced troops by rapid development of fire at the required points.

(ii) Gripping on to ground gained, and covering the deployment of the main body by holding the enemy on a wide front.

(iii) Protecting an exposed flank or flanks.

4. Although an advanced guard will necessarily act on a wide frontage (*i.e.*, abnormally wide in proportion to its strength), the necessity for *depth* in the distribution of machine guns must not be overlooked.

5. The bold and skilful handling of limbers will be of great importance in the quick moving fight of an advanced guard.

THE ATTACK.

1. The main duty of machine guns throughout the whole course of the battle is the energetic and determined support of the infantry.

This support is afforded by—

i. The provision of covering fire to facilitate the advance of the infantry when checked.

ii. Protecting the flanks of the infantry against counter-attacks.

iii. Forming pivots upon which the infantry can rally if driven back.

iv. The provision of a reserve of fire power in the hands of commanders for offensive or defensive purposes, as the situation may demand.

2. In considering the initial allotment of machine guns in the attack, the first essential is the retention of an adequate reserve in order that, as the battle progresses, machine gun resources may be available for reinforcement of the front, protection of the flanks, and provision of reliefs as the situation may demand. The reserve thus fomed will be under the command of the Brigade M. G. Commander acting under the orders of the Brigade Commander.

3. After the initial reserve has been decided upon, the remaining machine gun units will be disposed for the support of the infantry which is to be deployed for the initial stages of the attack, and will carry out the duties enumerated in para. 1, i, ii, iii above.

Those duties cannot be performed effectively unless the available machine gun units *are disposed in depth*.

For this reason these units will normally be divided into—

(*a*) Forward guns; whose rôle is to work forward in immediate support of the leading infantry battalions.

(*b*) Supporting guns; which will be disposed so as to (i) consolidate tactical localities as they are won (thus freeing infantry for the further advance), (2) assist in gaining superiority of fire in the event of serious resistance being encountered in any part of the area over which the formation is operating, or (3) cover the flanks.

4. In order that *continuous* support may be afforded to the attacking infantry, it will frequently be necessary for supporting guns to advance through and beyond the forward guns, the latter taking up (temporarily) the rôle of supporting guns. Normally, therefore, both the forward and the supporting guns must operate under the orders of one machine gun commander acting under the instructions of the brigade commander.

This system of "leap-frogging" will be particularly necessary in operations in which the advance may be continuous and may cover considerable distance, *e.g.*, where the enemy has been driven back but is still offering resistance.

On the other hand in operations in which the attacking force has a limited objective (*i.e.*, when the attack is in the nature of a "set-piece" and the length of the advance is limited), it will often be advisable that the same machine gun units should act as forward guns throughout the operations in hand up to the consolidation of the objective. Again, owing to the nature of the country, or for other reasons, it may not be considered possible for the action of the forward and supporting guns to be controlled by one and the same commander. In these cases it may be expedient to allot the forward guns to definite infantry units for a limited period or phase of the operations.

Machine gun units so allotted will act under the orders of the infantry battalion commander during the period or phase of the operation for which they have been detailed to support that particular battalion, subsequently reverting to control by the brigade M. G. commander.

5. No hard and fast rule can be laid down to determine the proportion of machine guns to be held in reserve, or the actual division into "forward" and "supporting" guns of those units detailed for the support of the infantry deployed for the attack.

The following must be considered when making initial distributions:—

i. Nature of the operation and rôle of the attacking force.

ii. Information as to hostile dispositions and strength.

iii. Nature of the country.

As a general rule, not more than two M. G. sections should be detailed to act as forward guns on the front of one brigade. The more units detailed for this rôle, the less will be the depth of the machine gun dispositions.

The general distribution at every stage of the attack must be such that—

(*a*) Commanders may have sufficient guns in reserve with which to obtain superiority of fire in the event of any serious resistance being encountered.

(*b*) Rapid intervention to a flank may be possible.

(*c*) Adequate distribution in depth may be maintained as a defence against possible counter-attack.

6. *Rôle and action of forward guns.*—In order that they may be able to afford immediate support to the leading infantry battalions, the forward guns must be prepared to deal rapidly with hostile opposition which interferes with the infantry advance or threatens their flanks, to cover gaps in the attack, or to form pivots on which the leading infantry can rally if driven back.

These duties call for aggressive action, and necessitate readiness to open fire at short notice. The line of advance of these guns should be the line which will take them with the least possible delay to the points from which they can most effectively engage the enemy. But mere gain of ground should not be attempted if it entails the sacrifice of a position already occupied which affords better facilities for carrying out the task in hand.

Machine gun units are not suited to take part in the close struggle for progress.

Immediate support involves constant vigilance on the part of the machine gun unit commander, forced marches combined with readiness for immediate action by all ranks, and great difficulty in replacing casualties. Constant relief is therefore necessary to ensure tired infantry being covered by fresh machine gunners. Such reliefs will only be possible when there are sufficient machine gun units in reserve.

7. *Duties of commanders of machine gun units acting as forward guns.*

i. Carry out personal reconnaissance well ahead of the unit.

ii. As the advance progresses, select fire positions which will—

(*a*) Enable the greatest support to be given combined with the minimum of bounds.

(*b*) Give command of ground from which enemy fire is likely to hold up the advance.

(*c*) Protect the flanks against counter-attack during the advance.

iii. *Use direct fire whenever possible*, as the time taken in applying fire must be as short as possible. Indirect fire, however, should be used when necessary, *e.g.*, when hostile artillery interferes with the necessary volume of fire. In such cases only the most simple method should be employed, *i.e.*, T. O. G. (short base).

iv. As far as possible maintain liaison with the commander of the infantry whose advance the guns are supporting. Keep him informed of disposition of guns and situation in vicinity and report personally to him from time to time as the tactical situation permits. Liaison with the headquarters of a particular unit is often difficult, and may not be necessary when more useful information can be obtained from the headquarters of another unit.

v. As unexpected situations arise, I decide on immediate course of action. If this action conflicts with the initial plan, inform the infantry commander as regards action taken and acquaint superior machine gun commander.

vi. If detailed for the immediate support of a particular infantry unit, report personally to the commander of that unit and put before him proposed plan based on reconnaissance.

8. *Action of supporting guns.*

The supporting guns may be employed to carry out the initial programme of covering fire, whilst the forward guns are in position of readiness, to advance in immediate support of the leading infantry.

The subsequent advance by bounds of the supporting guns will be necessary for the purpose of increasing the volume of covering fire on those localities or frontages where, as the situation develops, the hostile resistance is found to be preponderant.

In selecting positions for the above purpose the subsidiary tasks of the supporting guns, *viz.*, consolidating successive objectives as they are gained by the leading troops, covering gaps in the attack and affording protection to the flanks, must not be overlooked.

Supporting guns may also be employed to pass through the leading infantry battalions to co-operate with other battalions detailed to exploit success (*c.f.* para. 4 above).

The rôle of the supporting guns necessitates active forward reconnaissance by the machine gun commanders in charge of these guns.

9. *Consolidation.*

The forward guns can assist consolidation by covering the reorganisation of the infantry, and assisting in repelling immediate counter-attacks.

Arrangements must also be made to utilise the long range fire of supporting guns to assist in consolidation by covering definite frontages or areas in front or on the flanks of the leading infantry.

By this means greater volume and organised depth will be obtained to deal with deliberate counter-attacks. Good distribution and redistribution during the advance will produce the required depth, but dispersion will result unless the brigade machine gun commander, acting under the orders of the brigade commander, formulates a plan which suits the brigade area as a whole.

LECTURE V.

MACHINE GUNS—(1) IN THE DEFENCE (2) WITH A REARGUARD.

---

(1) THE DEFENCE.

1. *General Considerations.*

i. Field Service Regulations lay down as a main principle that victory can be won only as a result of offensive action. Consequently a defensive attitude must be assumed only in order to obtain or create a favourable opportunity for decisive offensive action.

ii. A commander who voluntarily decides, or is forced by enemy actions to assume a defensive attitude, will economise as much as possible in the troops allotted to a defensive rôle, in order that he may have the greatest possible force available for offence.

iii. Machine guns, by reason of their great fire power and annihilating effect at medium and short ranges, will assist in effecting this economy and will therefore form an important part of the framework of the defence.

iv. In every battle, especially when large forces are engaged, there may be many alternations of attack and defence, and the time required by either combatant to complete his preparations for offensive action may be so prolonged as to lead to a period of position warfare, thus permitting of elaboration of defensive measures.

v. *Organised depth is essential in defensive dispositions.*—At the conclusion of a battle, command and control is at its weakest. This is due to difficulty of communication, depletion of reserves, and to the uncertainty of units as to the position and intention of neighbouring units. Thus each unit re-organises to meet the requirements of its own area only, which results in—

(*a*) A number of areas each organised for defence.

(*b*) Little or no co-ordination of areas, leading to waste in man power.

(*c*) The bulk of the troops being disposed in the more forward areas.

Whenever the enemy's attack has been brought to a standstill, therefore the defender must regain organised depth in order to continue the defence successfully and to create a favourable opportunity for a counter-stroke. (*Cf.* "Consolidation in the Attack.")

2. *Rôle of machine guns.*—As in the attack, so also in the defence, the rôle of machine guns is to afford support to the infantry. The duties of machine gun units in the scheme of defence will therefore be :—

i. To assist the infantry in the outpost zone to check and to disorganise a hostile attack.

ii. To assist in the defence of the main battle position.

iii. To check the advance of the enemy whether forward or laterally, should he penetrate into the main battle position.

iv. To assist the infantry and tanks in the execution of counter-attacks.

General distribution—command.

i. In order that they may carry out the above duties machine gun units must be *disposed in depth*. The actual depth to which the machine gun defence should be carried should normally include the main field artillery positions.

ii. In determining on the initial allotment of machine guns, the brigade commander must first set aside a portion of the available machine gun units as a mobile reserve, to be used either (*a*) to stiffen the defence if necessary, or (*b*) to co-operate with troops detailed to carry out a counter-attack. Positions must be prepared for these reserve guns, generally in the rear zone of the main battle position. Normally the reserve guns will occupy these positions directly the hostile attack materialises, but they must retain their mobility in order that they may be able to reinforce the front, protect the flanks or support troops detailed to carry out a counter-attack.

iii. After the reserve has been detailed the bulk of the remaining available machine gun units must be disposed for the defence of the main battle position. Only a small portion of these units must be allotted for the support of the troops in the outpost zone (see para. 4).

iv. The brigade commander must consider the brigade sector as a whole and make an allotment suitable to the *ground* irrespective of the actual frontages allotted to infantry battalions. A rigid allotment of machine guns to definite infantry units will lead to waste of fire power and lack of co-ordination.

v. Since the machine gun defence of a tactical feature is best ensured by placing the machine guns away from and on the flank of, rather than on, the feature, machine guns will not necessarily be positioned in the area of the unit whose front they are covering. Consequently the control and co-ordination of machine gun effort in the defence must rest in the hands of the brigade machine gun commander acting under the orders of the brigade commander.

vi. No attempt should be made to site machine guns so that every yard of ground is swept by their fire. Machine gun fire should be reserved for protection on a larger scale, covering the more important features or localities and denying to the enemy the most favourable routes of advance. The scheme of machine gun defence must form part of the scheme of fire power as a whole; co-ordination with the infantry (especially their Lewis guns) and with the artillery and trench mortars is therefore essential.

4. *Machine guns allotted for the defence of the outpost zone.*—The rôle of these guns is to assist the infantry in the outpost zone to break up the enemy's attack and delay his advance and to cover selected infantry posts against surprise attacks. Machine gun units detailed for these duties will usually be disposed by sub-sections and will be employed mainly to assist in the defence of the outpost line of resistance.

The flanks of prepared infantry localities and the intervals between them should be covered by machine gun fire, this fire being reinforced, if possible, by the fire of machine gun units allotted to the defence of the main battle position (see para. 6).

Machine guns should rarely be placed in the area subject to intense trench mortar fire. Efforts should be made to cover the required features from outside this zone.

5. *Siting machine gun positions on the ground.*—In selecting positions suitable for the tasks allotted, M. G. commanders must bear the following in mind:—

i. An extensive range along the most important line of fire is essential.

ii. The field of view should be as wide as possible.

iii. The position should be capable of all-round defence; this will seldom be possible except by the use of alternative positions, which must be selected at the same time as the main position.

iv. The best way to cover a feature is to place the guns to a flank of and away from the feature.

v. The ground by which access is gained to the feature or locality it is intended to cover must be closely examined, so as to ensure the greatest possible killing power from the guns.

vi. Local protection must be ensured.

vii. The effect of hostile artillery fire must be borne in mind.

viii. The use of wire or other obstacles and of dummy positions must be considered.

ix. The control of tracks leading to the gun position must be arranged.

x. The arrangements for carrying out subsidiary tasks, *e.g.*, harassing fire, must be considered.

xi. Adequate cover must be provided for the gun detachments whenever possible.

6. *Fire tactics.*—The main principle on which the scheme of machine gun defence must be based is the power of the guns to arrest the progress of the enemy by *direct fire* at medium and close ranges.

Indirect fire can be employed when it is not possible to deal with the target by direct fire, and can also be used to assist in disorganising the enemy during the opening stages of an attack. For instance, the long range fire (probably indirect) of machine guns in the main battle position may be usefully employed to assist the troops defending the outpost zone.

The employment of the long range fire of these guns will, however, be limited by consideration of ammunition supply, *i.e.*, the necessity of retaining sufficient ammunition to cover, by means of direct fire at medium and close ranges, the ground for the defence of which these guns are primarily responsible.

As smoke, mist or darkness may obscure vision, all machine guns normally sited for direct fire must also be able to fire on their lines by indirect means if necessary.

7. *Retirements.*—Although the enemy's advance does not necessarily entail the withdrawal of machine gun units, it may happen that such a withdrawal must be carried out to conform with the movements of troops on the flanks. The success of such an operation will depend on—

i. The plan being communicated to and understood by all concerned.

ii. Close liaison between machine gun, infantry, and artillery commanders.

(2) REARGUARDS

1. As a rearguard will usually be required to operate on a comparatively wide front (in proportion to its strength) and to hold positions with the minimum number of infantry, a large proportion of machine gun units should be allotted to form part of the rearguard.

2. Experience has shown that well-placed and skilfully handled machine guns can, with the support of a small number of infantry, check for long periods the advance of comparatively large numbers of troops.

3. The principles upon which all rearguard action should be based are laid down in F. S. R.

In the application of these principles, the following points in connection with the employment of machine guns should be noted:—

(*a*) Direct fire should be used. Fire should be opened at long range on suitable targets, but with due regard to the supply of ammunition. Positions should be selected to give a wide and comprehensive field of fire.

(*b*) Machine guns should be disposed mainly on the flanks.

(*c*) Guns should be handled in sections as far as possible.

(*d*) Defence in depth must be maintained by the retirement of alternate sub-sections or sections.

(*e*) Guns should be sited with due regard to the prospects of ultimate withdrawal.

(*f*) Full use should be made of limbers and pack animals for withdrawal, as well as for forming ammunition dumps in suitable places near positions on which the guns will fall back.

(*g*) Surprise effect must be sought, but the necessary concealment must not interfere with the mobility which is necessary to ensure that successive withdrawals occupy the minimum amount of time.

4. While the withdrawal of machine guns should not take place until the latest possible moment consistent with the tactical situation, the necessary arrangements should be foreseen and prepared.

These arrangements will involve—

(*a*) The previous selection of positions in rear. If these positions can be sited so as to cover the flanks of the more forward guns, additional power will be given to the defence.

(*b*) The reconnaissance of covered lines of withdrawal.

(*c*) The close proximity and full use of limbered wagons and pack transport.

5. While, as a general principle, a portion of the machine guns should be left in rear to cover the withdrawal of the bulk of the infantry, it is essential that parties of mobile troops should remain to cover the withdrawal of the machine guns.

6. In a withdrawal, the closest co-operation is necessary between machine gun and infantry units. Otherwise, when orders to withdraw are received by the infantry, they may not be communicated to the machine gun units. This omission may result in the guns being left in their old positions until it is impossible to withdraw them owing to the lack of any covering fire.

LECTURE VI.

"INDICATION AND RECOGNITION OF AIMING MARKS AND JUDGING DISTANCE BY THE MACHINE GUNNER."

"Indication and Recognition."

1. *Definitions*:

Indication.—The shortest and most easily understood description of an aiming mark by a fire unit commander.

Recognition.—The soldier's understanding of the exact point at which the commander wishes him to aim.

2. *Accuracy*:

Essential for machine gun work—

(*a*) The close grouping of the bullets.

(*b*) Safety of our own troops.

3. *System of Training*:

Based on knowledge of the following:—

(*a*) Military vocabulary.

(*b*) ability to apply judging distance.

(*c*) Description of targets located by means of field glasses.

4. *Preliminary arrangements*:

Unmistakable prominent aiming marks simply need naming and the firer's eyes instinctively pick them up.

Aiming marks which are not so obvious call for a more certain way of leading the firer's eyes to the correct point of aim.

To enable the latter to be indicated and recognised the following must be described immediately a fire unit comes into action:—

Define your front

(*a*) *Front.*—Guns should always be mounted with reference to a definite and convenient frontal reference point, within the arc of fire allotted.

(*b*) *Reference points.*—These should be unmistakable, the number described depending on the arc to be covered.

The distance between any two reference points should not exceed two hand spans.

Define your arc, which is, giving two lateral limits to the direction in which the target will, or is likely to, appear.

5. *Method*:

(*a*) Range indicated first when possible in order to limit the distance of the aiming mark, thus acting as a guide in picking it up.

(*b*) Actual location indicated by directing the firer's eyes from a clearly defined starting point (reference point) towards the required aiming mark.

6. *Aids to Location*:

Direction.—Clock face angle. finger method.

Displacement.—Visual angles, *i.e.*, angles subtended by one's own hand, graticule cards, graticule glasses and dials. ⊗

One or both of these aids can be employed as necessary. Sometimes recognition is simplified by ordering dials to be used by the firers.

Judging Distance.

1. *Officers and N. C. O.'s.*

Officers and N. C. O.'s must learn to estimate distances between 600 yards and 1,500 yards.

The 600 yards distance is particularly valuable when reconnoitring positions in the defence.

Correct estimation of the distance between 800 yards and 1,500 yards in conjunction with the arc to be covered, ~~are~~ important factors when determining the size of the fire unit required.

2. *Men.*

The individual machine gunner must be taught to estimate "fixed sights" (up to 600 yards) and "close range" (up to 800 yards) distances.

He must in addition be capable of making reasonable estimates of distances up to 1,500 yards, to assist him in "recognition." (*See* para. 5 above.)

⊗ The displacement of the thumb is roughly $\frac{1}{10}$ of the distance.

Men should be first trained to judge from 100-600" as the fixed sight of a V.B. can be used up to + including 600".

It is ∴ essential that they should know accurately what 600" looks like.

LECTURE VII.

"FIR E ORDERS."

Definition

1. *Necessity for Fire Orders.*—A fire order is the final précis of the solution (?) summing up of a fire direction problem and it is in this form that a task is conveyed to the firers. Therefore unless definite, concise and easily understood orders are issued, the solution of fire direction problems is rendered valueless.

2. *Sequence.*—A pre-arranged sequence makes for conciseness, prevents important points being omitted and enables the firers to act with certainty on receipt of an order.

The following sequence is applicable to all orders, whether fire is direct or indirect.

Orders to open fire—

A 1. Range or ranges (when firing indirect the range should follow 4, below).
2. Dials (if considered necessary).
B 3. Indication of target or aiming mark.
4. Nature of fire if applicable (*e.g.*, "Distribute").
C 5. Executive order "Fire."

Orders during firing— should be given in following order

1. Deflection (*e.g.*, 2 degrees move right). Alteration in direction
2. Elevation (*e.g.*, up 10 minutes or up 100 yards).

Orders to cease fire— When given :- task finished New target

1. Cease fire.
2. New target (indirect fire only).

3. *Method of delivery*—

(*a*) In writing.
(*b*) Verbally through orderly or connecting file.
(*c*) By signals ↓ word of mouth.

Whenever possible anticipatory orders should be given to the gun commanders.

When dealing with fleeting targets method (*b*) will generally have to be used, (*c*) being employed when circumstances are favourable.

Method (*c*) although valuable from a drill point of view is often impossible on service for the following reasons :—

1. Difficulty of hearing the order owing to noise, which may lead to misinterpretation.
2. As the position of the fire unit commander must be chosen within shouting distance, this may not be suitable for observation of fire, movements, etc.

4. *Training.*—Fire orders demand on the part of the commander quick appreciation of the nature and volume of fire required, and skilful observation of fire together with good "indication."

Constant practice is necessary, and failure to obtain fire effect with trained personnel is a reflection on the commander.

Training must ensure all types of targets being engaged :—

(*a*) Targets of limited width and depth.

(*b*) Targets possessing considerable depth but little width.

(*c*) Linear targets.

(*d*) Oblique linear targets.

(*e*) Areas.

5. *Machine Gun Signals.*—The following signals will supersede those given in S.S. 221 for controlling movements and fire :—

"Action."—Both arms, fully extended, raised from the sides to a position in line with the shoulders and lowered again. This motion to be repeated until it is seen that the signal is being complied with.

"Out of Action."—Arm swung in a circular motion in front of the body.

"Gun ready to fire."—The No. 2 will extend his left arm horizontally.

"Stand by, ready to fire."—The controlling officer will raise his hand.

"Fire."—The controlling officer will drop his hand. The No. 2 will tap the No. 1 lightly on the back and order "Fire," and will then lower his left arm.

"Cease fire."—The controlling officer will wave his forearm horizontally, elbow close to the side. The No. 2 will tap the No. 1 lightly on the back, and order "Cease fire."

The following semaphore code will be used to convey :—

1. *Orders* :

U.—Up 50 yards (or up 10 minutes).

N.—Down 50 yards (or down 10 minutes).

T.—30 minutes more right.

L.—30 minutes more left.

To double or further increase the above corrections, the code letter will be repeated as necessary.

2. *Information* :

K.—Fire observed correct.

Q.—Fire unobserved.

B.—More ammunition required.

W.—More water required.

H.—Limber to come up to gun position.

LECTURE VIII.

"COVER."

1. In mobile warfare cover from view is more important than cover from fire, although a combination of the two is most desirable when it can be obtained.

2. Types of Cover.

Folds in the Ground.—Difficult to locate. The line of sight should be only just above the rise. The rise should not form a sky-line to the enemy.

Mounds of earth, ditches, etc.—The guns are best sited to fire obliquely over the rise.

Hedges.—(*i*) In the hedge itself. (Muzzle blast may give away position.)

(*ii*) In front of hedge and in the shadow.

(*iii*) Behind the hedge and firing through it. (Makes individual observation difficult.)

Crops.—(*i*) Afford good cover, but are often difficult to observe.

(*ii*) Tracks show up very easily, especially from the air.

(*iii*) Guns best sited on the edge. (Experience shows that when firing through a crop the bullets become considerably deflected, even at short ranges. Fire effect is therefore lessened.)

In trees.—Not recommended, on account of loss of control and volume of fire.

Woods.—(*i*) Site guns well in front if possible.

(*ii*) Failing (*i*) site well inside.

(*iii*) Rarely site on the edge of a wood.

(*iv*) Woods are usually marked on map, so form definite aiming mark.

Houses.—(*i*) Give cover from view, and to a certain extent, from fire.

(*ii*) Owing to the fact that not more than one gun can, as a rule, be put in each room, control and communication with Section Officer becomes very difficult.

(*iii*) More useful for O. P.'s than for gun positions, but it may often be necessary to site guns in houses in order to obtain command.

(*iv*) Avoid *isolated* houses.

(*v*) Preparation for immediate occupation of alternative positions.

Hay Stacks and Stacks of Corn, etc.—Generally, as for "Houses."

3. Points relating to Cover to be Sought for in the Selection of Machine Gun Positions.—(See also Summary of Lecture, "Reconnaissance") :—

(*i*) Guns sited as low as possible, compatible with fire effect.

(*ii*) Avoid sky-line.

(*iii*) Consider background, foreground, and nature of ground in vicinity.

(*iv*) When choosing actual gun position see that your eye is the same height as that of the firer.

(*v*) Alternative positions with good approaches.

(*vi*) Good observation.

(*vii*) Radius of fire as ordered and at least a 600-yards field of fire all round is the ideal, but is rarely, if ever, obtainable. Consequently the use of alternative positions must be resorted to to c ver ground over which the enemy is likely to approach from any direction.

(*viii*) Good position for limbers, as close up to gun position as the tactical situation will permit.

(*ix*) Use of dummy positions.

4. AVOID—

(*i*) Obvious positions (usually isolated).

(*ii*) Positions easy for the enemy to range on (*e.g.* an isolated hedgerow or bank).

(*iii*) Positions near a very prominent landmark.

(*iv*) Positions on ground affording easy observation to the enemy.

22

LECTURE IX

"MACHINE GUN LIMBERS AND PACK."

1. Important that a high standard of efficiency is maintained in equitation, driving and horsemastership. All officers should be capable of training their drivers and looking after the welfare o f their animals.

2. *Machine Guns are carried*—

(*a*) In limbered wagons.

(*b*) On pack animals only.

(*c*) By a combination of (*a*) and (*b*).

(*a*) *In limbered wagons.*

A machine gun section (4 guns) has three limbers, *viz.*, two "fighting" and one "No. 3" or "ammunition" limber. Each "fighting" limber is drawn by four horses, for speed plus weight (*cf.* M.G. Training, pp. 66 and 67).

In difficult country guns and the most important equipment can be moved by using half-limbers (see load table).

NOTE.—With two poles half-limbers can be used separately, but the following extra equipment is required :—

2 pole-bar supporting straps.

2 swingle trees and fittings.

(*b*) *By pack animals only.*

In certain Eastern theatres of the late war a Machine Gun Section carried its equipment on 20 pack mules and in one small two-wheeled Indian cart drawn by two small mules.

The loads of a gun team were as follows :—

No. 1 mule.		Gun, tripod, spare parts, spare barrel, oil.
,, 2	,,	Six belt boxes, water, condenser tube and bag.
,, 3	,,	Six belt boxes, water.
,, 4	,,	Six belt boxes, 2 picks, 2 shovels.
,, 5	,,	Spare.

The Section A. T. Cart carried two more belt boxes per gun, and certain equipment which is difficult to carry on pack, *e.g.*, cooking pots, Barr & Stroud box, Very pistols, night firing lamps, etc.

Besides the above each M. G. Section had attached to it six or seven pack animals from a Supply and Transport Company for carrying—

The remainder of the ammunition.
Water.
Signalling equipment, etc., etc.

These animals were termed 1st Line Transport.

The 2nd Line Transport consisted of a number of two-wheeled carts for baggage and supplies.

23

(c) *By a combination of (a) and (b).*

Machine gun units equipped with limbers also carry pack saddles on the off horses of the fighting limbers (*i.e.*, four pack saddles per section).

This method will be the usual one employed in Western Europe, and entails transferring equipment from limbers to pack when the situation demands (*cf.* highly developed trench systems, France, 1918).

Only a limited amount of equipment can be carried on pack by this method (see M. G. Training, p. 75).

Regarding (*a*) (*b*) and (*c*) methods referred to above, war experience has shown that in practically all theatres of war method (*c*) is the right one. It is only a question of the *proportion* of wheels to pack, which will vary according to the nature and existing conditions of the country.

3. *Comparison of limber and pack systems.*

	Advantages.	Disadvantages.
Limber.	Great speed.	(i) Big target. (ii) Of limited use in a roadless or mountainous country or crossing highly developed trench systems.
Pack.	Can go practically anywhere.	(i) Slow. (ii) Extravagant in personnel and animals. (iii) Increases fatigue of personnel. (iv) Liable to loss and damage of equipment.

4. *Notes on packing limbers.*

(*a*) Put on the brake.

(*b*) Balance the load to avoid weight on the pole.

(*c*) Examine all split pins.

(*d*) Quiet work, to avoid frightening the animals.

(*e*) Economise space by close packing.

(*f*) Avoid lowering tail boards. If necessary, avoid dumping heavy weights thereon.

(*g*) When packing or unpacking is completed, take off the brake.

5. *Notes on loading pack animals.*

(*a*) Load in "quick time." "Doubling" up to an animal is liable to make it restive.

(*b*) Ensure that loads are evenly balanced.

(*c*) Loading (and unloading) should be done simultaneously on each side of the animal.

(*d*) See that no article of equipment is likely to gall the animal.

(*e*) Ensure that all straps are securely fastened.

LECTURE X.

"CARE OF MACHINE GUNS AND MOUNTINGS."

1. The best results with machine gun fire can only be obtained when the apparatus is in perfect order and adjustment.

It is necessary to have a practical knowledge of where inaccuracies may creep in, and how to overcome and avoid them.

2. To maintain guns and mountings in correct working order they must have a periodical examination and overhaul by the Battalion Armourer.

Instructions for the care and examination are given in the handbook of the ·303 in Vickers Gun, Sections XII and XIII. Attention will be drawn to the monthly "list of changes."

3. Breakdown to guns can be attributed to the following causes:—

(*a*) Avoidable damage.

(*b*) Stoppages or damage caused in the ordinary course of events.

(*c*) Stoppages or damage of an exceptional nature requiring factory repairs.

(*d*) Faulty ammunition.

4. Barrels, approximate life of, liability to breakdown. Modification to—

(*a*) Trunnion blocks. L. of C. No. 19543. 1/12/17.

(*b*) Alteration to breech face. L. of C. No. 21895. 1/4/19.

(*c*) "S.C."

(*d*) "T."

5. Testing of guns for accuracy of—

(*a*) Sighting, lateral and vertical errors.

(*b*) Grouping.

Testing barrels for accuracy is carried out at 500 yards on the classification range, a special target being used. (See Summary of Lecture, "testing of Barrels for Accuracy.")

6. A Worn Tripod, or one that has been allowed to get into disrepair, is a most fruitful source of inaccuracy in shooting. A brief description of where, and how, unsteadiness may arise in—

(*a*) Legs.

(*b*) Socket.

(*c*) Crosshead and pivot.

(*d*) Elevating gear.

A pamphlet entitled "Notes on the care and adjustment of the Mark IV tripod" (issued by the Machine Gun School) deals with the causes of unsteadiness in the Mark IV tripod, the examination and detection of wear and the remedy to be applied.

LECTURE XI.

"TESTING BARRELS FOR ACCURACY."

Vide M. R. Part I. (Reprint 1914), Section 13. Equipment Regulations, Section VI, para. 212.

Gun and mounting must be in perfect order.

Gun and mounting in perfect order, barrels can be tested for accuracy.

Gun and barrel in perfect order, mountings can be compared or tested for steadiness.

Apparatus Required :—

Range.—500 yards.

Butts.—Target, telephone, markers, A.F.B. 202, steps, pencils, ruler, etc., etc.

Details of target and aiming mark :—

Firing Point.—Guns and mountings and accessories, telephone, red flag, notebook, etc.

Ammunition of uniform make, to be carefully filled into belts, and spaced.

Conduct of Firing.—Favourable day, reliable firer, warmers, sighting, continuity of groups, rounds in group, recording groups and point aimed at.

Compiling A.F.B. 202.—Entering in the details, numbering the shots, measurements—horizontal, vertical, rectangle—point of mean impact, deviation, figure of merit.

Limits of accuracy :—For rifle, 1 foot; for machine gun barrels, 1·5 feet.

Barrels exceeding the above limitations are deemed to be inaccurate, and should be exchanged.

Life of Vickers Gun Barrel and certain "Spare Parts."

The following are copies of letters relating to the life of Vickers gun barrels and certain "spare parts."

G.H.Q. letter No. 7/23 (Q.B.3), dated France, 1/10/1917, will have been written after the experience of the battles of Arras, Vimy, Messines and possibly Paschendaale.

War Office, London. S.W.,
22/10/17.

77/6/4854 (A.3).

General Officer Commanding, M.G.T.C.,
Grantham.

With reference to yours 15676/G/M.G.T.C., dated 29th September, inquiring as to the life of a Vickers Gun Barrel at various rates of fire, and whether an Army Council Instruction was being issued; at one time it was proposed to issue an A.C.I. dealing with a method of testing and marking worn barrels at out-stations so as to distinguish barrels suitable for overhead indirect fire from those which were not suitable, but as it was thought that confusion might arise from having barrels of two qualities in the Field, the matter has therefore been dropped. Please see following copy of a letter from General Headquarters, France, dated 1st October 1917, relative to the life of a Vickers Gun Barrel, etc.

(Signed) E. HESKETE, for
Director of Artillery.

7/23(Q.B.3).
General Head-quarters.
1/10 1917.

From
The Field Marshal Commanding-in-Chief, British Armies in France.

To
Secretary, War Office, London, S. W.

SIR,—I have the honour to inform you that in view of the increasing use of Vickers M.Gs. for Barrage work and the consequent increased expenditure, endeavours have been made to obtain some statistics as to the life of the barrel of the M.G. at the various rates of fire and information as to the parts of the gun which seem specially prone to wear.

Life of Barrels:—Reports have been obtained from various sources on the results of firing several million rounds. These have been compiled, and the following conclusions have been arrived at:—

(*a*) In the case of a low rate of fire with regular and continuous cleaning and oiling and when the water in the barrel-casing is not constantly boiling, the average life is about 20,000 rounds.

(*b*) In the case of rapid and continuous fire, as used for S.O.S. calls and offensive barrage work, the life is from 12,000 to 15,000 rounds.

(*c*) For fire other than barrage fire over the heads of our own troops, the life is about 25,000 rounds.

It is considered that, in computing the number of barrels required for an operation the life of a barrel should be considered as 15,000 rounds.

Parts Specially Prone to Wear.

(*a*) Firing pins.
(*b*) Fusee springs.
(*c*) Lock springs.
(*d*) Extractor grooves.
(*e*) Check lever brackets, work loose.
(*f*) Covers, Gib spring, work loose, thereby preventing the extractor from rising easily.

In a special report received on the results of the firing of 3,160,000 rounds in Harassing Fire by 32 guns the average life of a Firing Pin was stated to be 19,300 rounds, of a Lock Spring 211,000 rounds, and of a lock 137,000 rounds.

I have the honour to be, Sir,
Your obedient Servant,
(Signed) [illegible]. FORDNEY, for
Field Marshal Commanding-in-Chief, British Armies in France.

Report on Endurance Trial with the ·303 Vickers Gun.

In 1916 a prolonged firing trial was carried out at the Machine Gun School, Grantham, to ascertain the suitability of the ·303 Vickers Gun for sustained fire, and such other points of interest that might be brought to light.

The ·303 Vickers Gun No. L. 6273 was practically new, and had only fired some 500 rounds previously. The gun was carefully examined before firing to make sure it was up to standard.

The weight of the fusee spring was 7½lbs, and the lockspring 13lbs. The muzzle cup Mark I. was attached in accordance with the instructions laid down.

The gun was fired from the Mark IV. tripod, which was new and rigid.

The ammunition was mixed brands of G. 16 and R. L.

The trial was carried out on the 25-yards range, and the same firer fired throughout the whole series, and had the assistance of trained Nos. 2, 3 and 4.

The total time occupied in the trial was 60 min. 4 secs., and during that time 55 belts were fired, making a total of 13,750 rounds.

The following is an analysis of the time :—

	No. of times.	Total time. min.	secs.	Average. min.	secs.
(*a*) Changing belts	54	7	21	—	8⅘
(*b*) Refilling with water and oiling	7	12	16	1	45
(*c*) Remedying stoppages . .	57	11	17	—	12
		30	54		
Actual time of .		29	10		

The following is an analysis of the rate of fire :—

	Rounds per min.
(*a*) Average rate of fire for the whole period of 60 min. 4 secs. .	22
(*b*) Highest rate of fire for one complete belt	555
(*c*) Slowest rate of fire for one complete belt	405
(*d*) Average rate of fire for the period of 29 mins. 10 secs. . .	471

Analysis of stoppages and time taken to clear

	Number.	Total time.	Average.
1st Position	7	22 secs.	3 secs.
2nd ,, ...	3	68 ,,	23 ,,
3rd ,, ...	23	436 ,,	18½ ,,
4th ,, ...	24	151 ,,	6½ ,,

The frequency of the 3rd position stoppages and the disproportionate time to remedy deserves notice. The front cover catch, if in good order and holding well, cannot be opened when the gun is hot without burning the knuckles of No. 1's fingers. The clearing plug had to be employed to lever it open, and it is estimated that almost half the total time occupied in stoppages was due to this cause alone.

WATER.

The amount of water used was 6 gallons. 4 pints for the 55 belts. This works out approximately one pint of water to each belt, exclusive of the first filling, and starting all cold it would not be advisable to fire the gun for more than 2,000 rounds before refilling.

OIL.

The total amount of oil used was ½-pint. The oil in the handles lasted 17 belts or 4,250 rounds, by which time the oil was used up and the brushes rendered useless, owing to the heat of the gun charring the hairs. The oil can was found quicker and more efficient.

The best "runs" of the gun were obtained after oiling, and the effect of oil appears to last about 4 belts, after that stoppages become frequent.

For comparison

	Belts.	Rounds.	Total time.	Average rate.
After oiling .	7—10	1,000	2 min. 28 secs.	406
	18—21	1,000	2 „ 24 „	417
	26—99	1,000	2 „ 23 „	420
	46—50	1,250	3 „ 16 „	382
Lack of oil .	51—55	1,250	5 „ 10 „	242
	40—43	1,000	5 „ 35 „	179

BREAKAGE.

One lockspring was broken in the 38th belt.

MUZZLE CUP.

The Muzzle cup gave no trouble during firing but was difficult to remove on the termination of the trials.

The front cone was filled up with metallic deposit which left little or no clearance between it and the muzzle cup when the recoiling portions were forward.

ACCURACY.

Grouping was good in the earlier stages, but showed a tendency to deteriorate at about the 40th belt due to accumulation of nickelling. This fouling was blown out periodically, noticeably in the 41st, 46th and 51st belt. The flash appeared to vary intensity, being most apparent during the period when the metallic fouling was being ejected.

GENERAL.

At the termination of the trial the firer complained of fatigue in the hands and the ball of the thumb became slightly numbed as a result of—

(*a*) Continued pressure.

(*b*) Vibration.

It is considered that the endurance of the Gun will outlast the endurance of any one firer. At the termination of the trial it was noticed that the Gun was running rather better than at the beginning, and firing might have continued indefinitely until the barrel was completely worn out.

Result of Examination of Gun and Barrel—

A thorough examination of Gun and Barrel was carried out subsequently at the Royal Small Arms Factory, but no defects of a serious nature were detected.

The principal minor defects in the Gun were as follows :—

Cover, front.—Bracket front Cover—hook slightly strained.

Crank.—Hexagon worn allowing ·02″ lift on crank handle at point of contact with Check Lever.

Block, feed.—Guide cartridge and stop combined—slightly worn and rivets show sign of slight movement.

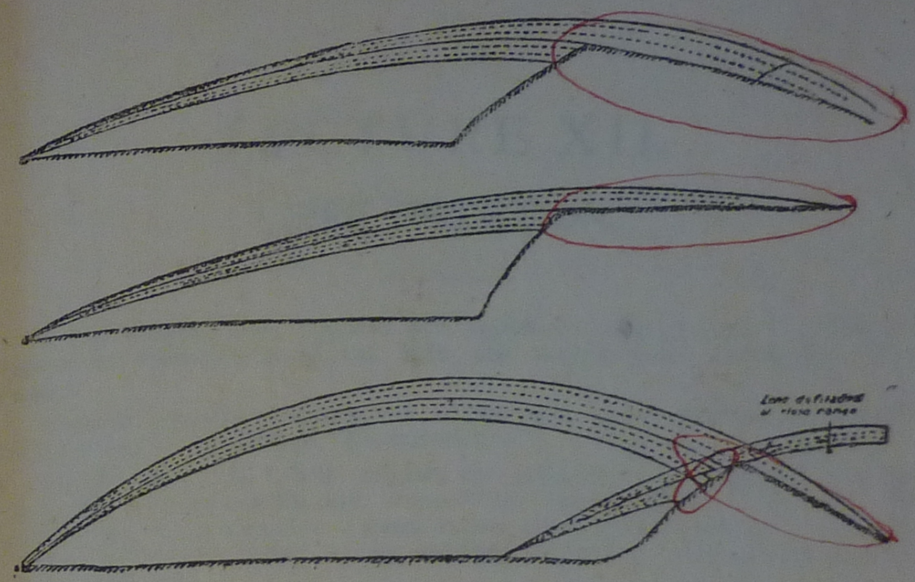
Plates, side.—Guides for lock—burred at rear end but not seriously.

Lock.—Shows signs of wear generally, the Tumbler head and bent were rather badly worn.

The examination and gauging of the barrel showed that the extent of metallic fouling was not excessive. The erosion at the lead was appreciable but not serious.

The barrel was fired for accuracy and gave a Figure of Merit well within the limits of accuracy.

Plate XVIII.



in a group varies—

(*a*) With the tactical necessity.

(*b*) With the technical necessity. (*See* S.S. 192, Part II, Table I, col. 7.)

3. *Technical Terms.*—(*See* S.S. 192, Part II, pp. 22-25.)

Axis of the bore.

Line of sight.

Trajectory.

The trajectory is caused by—

(*i*) The explosion of the charge.

(*ii*) The resistance of the air.

(*iii*) The force of gravity.

Culminating Point.

Cone of fire.

Beaten Zone. (The 90 per cent. B.Z. is considered.) (*See* Table I, col. 5, S.S. 192, Part II.)

First catch } The distance between these is called the Dangerous
First graze } Space.

Angle of Descent.—The length of the dangerous space depends upon this angle. (*See* Table I, col. 3.)

4. *Effect of Slope of Ground.*—If the ground makes a "forward slope" with reference to the line of sight the B. Z. is shortened.

If it makes a "reverse slope" with reference to the line of sight, the B.Z. is lengthened. At short ranges the effect of slopes is much greater than at long.

[*See* S.S. 192, Part II, Chap. 3 (2).]

At the termination of the trial the firer complained of fatigue in the hands and the ball of the thumb became slightly numbed as a result of—

(*a*) Continued pressure.

(*b*) Vibration.

It is considered that the endurance of the Gun will outlast the endurance of any one firer. At the termination of the trial it was noticed that the Gun was running rather better than at the beginning, and firing might have continued indefinitely until the barrel was completely worn out.

Result of Examination of Gun and Barrel—

A thorough examination of Gun and Barrel was carried out subsequently at the Royal Small Arms Factory, but no defects of a serious nature were detected.

The principal minor defects in the Gun were as follows :—

Cover, front.—Bracket front Cover—hook slightly strained.

Crank.—Hexagon worn allowing ·02″ lift on crank handle at point of contact with Check Lever.

Block, feed.—Guide cartridge and stop combined—slightly worn and rivets show sign of slight movement.

Plates, side.—Guides for lock—burred at rear end but not seriously.

Lock.—Shows signs of wear generally, the Tumbler head and bent were rather badly worn.

The examination and gauging of the barrel showed that the extent of metallic fouling was not excessive. The erosion at the lead was appreciable but not serious.

The barrel was fired for accuracy and gave a Figure of Merit well within the limits of accuracy.

LECTURE XII.

"FIRE DIRECTION."

1. *Fire Tactics.*—Fire direction and tactics are inter-dependent. Both are based on the characteristics of the M.G. and may be called collectively "Fire Tactics."

The most important characteristic of the M.G. is the platform from which the gun is fired. (*See* Lecture "Characteristics.")

The duty of the M.G. is to support the infantry, by giving the latter fire superiority. To carry out this task successfully, volume of fire is essential. To obtain volume of fire, a number of guns under one control is necessary. Therefore, the section of four guns is the smallest tactical unit for purposes of fire direction and control.

In dealing, then, with fire direction, we shall almost always be considering the fire of one or more "tactical units."

The usual object of fire is to cover movement. M.G. fire is, therefore, usually "covering fire," and most covering fire is "overhead fire."

2. *Method of M.G. Fire.*—M.G. fire is applied by "groups." A group is a very rapid succession of shots—8 or 9 per second. The number of shots fired in a group varies—

(*a*) With the tactical necessity.

(*b*) With the technical necessity. (*See* S.S. 192, Part II, Table I, col. 7.)

3. *Technical Terms.*—(*See* S.S. 192, Part II, pp. 22-25.)

Axis of the bore.

Line of sight.

Trajectory.

The trajectory is caused by—

(*i*) The explosion of the charge.

(*ii*) The resistance of the air.

(*iii*) The force of gravity.

Culminating Point.

Cone of fire.

Beaten Zone. (The 90 per cent. B.Z. is considered.) (*See* Table I, col. 5, S.S. 192, Part II.)

First catch } The distance between these is called the Dangerous
First graze } Space.

Angle of Descent.—The length of the dangerous space depends upon this angle. (*See* Table I, col. 3.)

4. *Effect of Slope of Ground.*—If the ground makes a "forward slope" with reference to the line of sight the B. Z. is shortened.

If it makes a "reverse slope" with reference to the line of sight, the B.Z. is lengthened. At short ranges the effect of slopes is much greater than at long.

[*See* S.S. 192, Part II, Chap. 3 (2).]

LECTURE XIII.

"CLIMATIC ALLOWANCES."

---

1. Machine guns are sighted for the following conditions :— Vickers

(i) Temperature : 60 deg. F.

(ii) Barometer : 30".

(iii) No wind.

If other climatic conditions prevail allowances must be made.

2. Variations of (i) and (ii) affect the density of the air, and demand allowances in elevation. (*See* S.S. 192, Part II, Table IV.) i.e. The denser the atmosphere the greater the resistance to the bullet.

Winds from front or rear also demand allowances in elevation. (*See also* Table IV.)

3. Side winds affect direction and are a much more difficult problem. The graph shows the allowances necessary for winds at right angles to the line of fire. If oblique, winds must be treated as shown in Table V, Oblique Wind Allowances.

The effect of winds is far greater at long ranges than at short owing to the greatly increased time of flight, allowing the wind much more time during which to act on the bullet. (*See* S.S. 192, Part II, Table VI.)

Winds are classified. Mild, ~~Fresh~~ Strong. i.e. 10, 20 & 30 mph.

In the case of a rear wind, it is necessary to deduct elevation as it increases length of trajectory.

" " " " head " , it is necessary to add elevation

Oblique winds effect both elevation & direction according to the angle the wind is blowing at & the rate at which it is travelling

∴ if firing on a level with the sea or under sea level, the elevation will have to be increased, & decreased if firing above sea level.
In cold weather more elevation will be reqd than in hot.

Climatic and other Influences and their Allowances.

The following are the normal conditions for the sighting of small arms :—

1. Barometric pressure, 30 inches (sea level).
2. Temperature, 60° Fahrenheit.
3. Still air.
4. A horizontal line of sight.

ATMOSPHERIC VARIATIONS THAT AFFECT ELEVATION AND DIRECTION.

When the barometer rises above 30 inches, more elevation than is normally required for the distance will be necessary, owing to the greater resistance offered to the bullet by the denser atmosphere. If the barometer falls below 30 inches, or at a height above sea level, less elevation will be required as the atmosphere will offer reduced resistance to the bullet. In the same manner the bullet meets with less resistance in hot weather when the thermometer is high, and greater resistance in cold weather when it is low.

The graph of allowances for climatic variations enables corrections for temperature and barometer heights to be calculated rapidly, and also shows the allowances necessary for winds.

It is used as follows :—

(*i*) *Barometer Curve.*

This gives the allowance necessary for a variation of one inch from the normal, *i.e.*, for a barometrical pressure of 29 inches or 31 inches. If the barometer stands below normal, the allowance must be deducted; if above, added.

For variations of more than one inch a proportionately greater allowance than that given by the curve must be made.

(*ii*) *Temperature Curve.*

This gives the allowance necessary for a variation of 20° from the normal, *i.e.*, for a temperature of 40° or 80° Fahrenheit. If the temperature is below normal, the allowance must be added; if above, deducted.

For variations of more than 20° a proportionately greater allowance than that given by the curve must be made.

NOTE.—Variations of less than one inch in the barometer or 20° in temperature need not be considered, unless they give allowances which have both to be added or both deducted.

(*iii*) *Head or Rear Wind Curve.*

This gives the allowance necessary for a wind of 20 miles per hour. For a head wind add the allowance; for a rear wind, deduct. For a wind of greater or less strength a proportionately greater or less allowance than that given by the curve must be made.

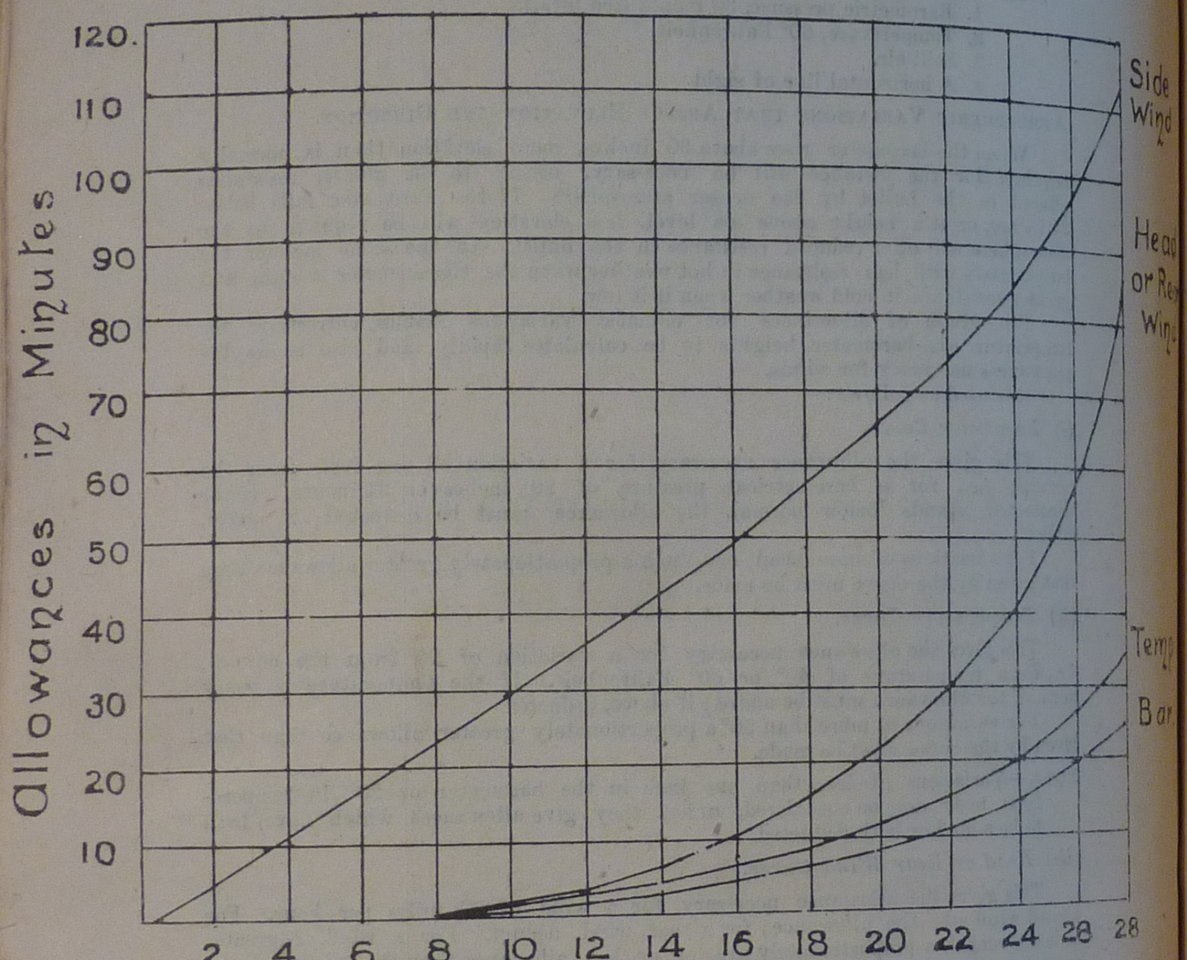
Halve the allowance for oblique winds.

(*iv*) *Side Wind Curve.*

This gives the allowance necessary for a wind of 20 miles per hour blowing at right angles to the line of fire. It is applied as a deflection towards the flank from which the wind is blowing. For a wind of greater strength a proportionately greater allowance than that given by the curve must be made. For a wind of less strength a proportionately less allowance than that given by the curve must be made.

Halve the allowance for oblique winds.

Graph of Allowances for Climatic Variations



Side wind curve } are for 20 miles per hour wind.
Head or rear wind curve }
Temperature curve is for a variation of 20 deg. from normal (60 deg. F.).
Barometer curve is for a variation of one inch from normal (30 in.).

EXAMPLE.

Range 2,0000x. Bar. 28·5″. Temp. 90°F. Wind oblique from Right Rear 30 m.p.h.

Elevation.

From Barometer Curve:		
Allowance for 1″ variation	= 8′	
∴ „ „ 1½″ „	= 12′	
This must be deducted		= — 12′
From Temperature Curve:		
Allowance for 20° variation	= 12′	
∴ „ „ 30° „	= 18′	
This must be deducted		= — 18′
From Rear Wind Curve:		
Allowance for 20 m. p. h.	= 22′	
∴ „ „ 30 „	= 33′	
This must be halved as wind is oblique	= 16′	
This must be deducted		= — 16′
Total allowance for elevation		= — 40′

Direction.

From Side Wind Curve:		
Allowance for 20 m. p. h.	= 66′	
∴ „ „ 30 „	= 99′	
This must be halved as wind is oblique	= 50′	
Wind is from Right ∴ Allowance is to Right	= 50′ Right.	

LECTURE XIV.

APPLICATION OF FIRE.

1. In order that fire may be correctly applied to a target it is necessary—

(i) To overcome errors of direction and elevation.

(ii) To distribute the fire over the target according to its size and shape.

2. *Application of Fire to Overcome Errors.*—To strike any target, guns must be correctly laid—

(i) For direction.

(ii) For elevation.

3. *Errors of Direction.*—Usual cause is wind. It is very difficult to estimate accurately the strength and direction of the wind, and thus to make the correct deflection, but it can be overcome by making allowances.

To overcome this it may be necessary to fire with the deflection due to the estimated wind and also with greater and less deflections.

The effect of this is to engage a width of ground greater than the width of the target, and thus make certain that the latter is included.

4. *Errors of Elevations.*—These are caused by—

(i) The difficulty of finding the exact distance of the target. (the greater range the greater difficulty)

(ii) Climatic variations.

The first is far the more important.

5. *Range Finding.*—The distance to a target is found by—

(i) Range finder — Barr & Stroud
(ii) Large scale maps } probable error—5 per cent.

(iii) Range cards ... probable error—10 per cent.

To overcome these errors, it may be necessary to fire with the elevation required for the estimated range and also with greater and less elevations. The effect of this is to engage a depth of ground greater than that of the target and of the B.Z. of the guns, and thus make certain that the target is included.

Best method:- observation of ranging fire but this cannot always be obtained

6. *Ranging.*—The process of determining by observation of fire the correct direction and elevation to hit any target.

This eleminates all errors both of direction and elevation.

This is of vital importance. No effort should be spared to obtain observation.

From wind tables, or by using two or more guns with differences in direction. Climatic conditions effect elevation. This can be overcome by using two or more guns, with differences in elevations, or by using tables.

7. *Observation of Fire.*—The following conditions facilitate observation :—

(i) A good O. P.
(ii) Good visibility.
(iii) Skilful use of field glasses.
(iv) Suitable objects on which to observe.
(v) Correct use of fire.

As regards: —

(i) The nearer the O. P. to the target the easier it is to observe.

(ii) The nearer the O. P. to the line of fire the easier it is to estimate the corrections required.

(iii) Experience is very necessary. Graticuled field glasses or cards are very useful. Corrections are estimated in angles for direction and in yards of range for elevation.

Both are transmitted to the guns as angles.

Signals used :—

U—Up 10′.
N—Down 10′.
T—30′ more right.
L—30′ more left.

If no observation is obtainable on or near target try and find a suitable object at a similar range.

(v) The more difficult it is to observe the greater must be the fire power employed *i.e.*, shoot with several guns simultaneously.

LECTURE XV.

"TRAVERSING—COMBINED SIGHTS—SEARCHING."

1. When observation of fire is unobtainable, errors of direction and elevation must be estimated and allowed for by distributing fire laterally and in depth so that it is certain that the target has been included.

2. *Traversing.*—The method of engaging any required width of ground by distributing fire laterally against it.

Traversing may be necessary—

(i) To overcome errors of direction. (See Lecture III, para. III.)
(ii) To engage a wide target.

3. *Searching.*—The method of engaging any required depth of ground by applying successively overlapping zones of fire. Searching may be necessary—

(i) To overcome errors of elevation. (See Lecture III, para. IV.)
(ii) To engage a target whose depth is great.

4. *Combined Sights.*—The method of engaging any required depth of ground by applying simultaneously overlapping zones of fire. Combined sights may be necessary—

(i) To overcome errors of elevation.
(ii) To engage a target whose depth is great.

5. *Necessity for Searching or Combined Sights.*

The permissible error. Half the length of the B. Z.
The probable error. (See Lecture III, para. V.)

If the probable error is greater than the permissible error, searching or combined sights must be used in order to make certain that the target is included.

6. *Oblique Traversing.*—A combination of traversing and combined sights. (See S.S. 192, Part II, pp. 39—40.)

LECTURE XVI.

"OBSERVATION OF MACHINE GUN FIRE."

---

1. *Definition.*—Observation of fire means the observance of one or more bullets striking the ground or the enemy, and is a necessary preliminary to ranging (or registering), which is the process of determining by observation of fire the direction and elevation required to hit a given target. (See summary of Lecture, Fire Direction III, para. 6.)

2. *Relation to "Fire Direction."*—Observation of fire must be taught as part of the practical side of Fire Direction. Leaders and men untrained in observing machine gun fire are unable to put into practice much of the theory of Fire Direction.

3. *Importance of the Subject.*—Once fire has been opened, subsequent fire orders depend upon the results of observation.

Slow and faulty observation of fire will result in loss of fire effect.

Observation of fire for indirect fire is as important as for direct fire, and must be sought for whenever the target area can be observed. Fire unit commanders must practise observing and controlling fire from positions such as would be used on service.

4. *System of Training* based on knowledge of, or training in, the following:—

(*a*) Practical knowledge of machine gun beaten zones at short, medium and long ranges.

(*b*) Appreciation of ground likely and unlikely to give observation of the bullet strike.

(*c*) Sufficiently long bursts of fire (i) to enable the area to be sufficiently covered with bullets to form a reliable beaten zone, (ii) to give the observer sufficient time to "find" a portion of the beaten zone and appreciate or "find" the remainder of the beaten zone.

(*d*) Visual training.

(*e*) Use of field-glasses to watch an area.

5. *Personnel to be Trained.*—Machine gunners must be taught to observe the fire of one gun at all machine gun ranges. Fire unit commanders must be taught to observe the fire of the fire unit, *i.e.*, the section of four guns, at all machine gun ranges because:—

(*a*) As regards machine gunners, they must apply fire from their own observation when superior control no longer exists.

(*b*) As regards fire unit commanders, they must control their fire units, on all occasions, as long as possible.

6. *Preliminary Instruction.*

"A"—*Individual instruction* :—

Individual instruction must be given progressively, and should consist in—

(*a*) Demonstrations of the cones of fire with tracer ammunition at 500 and 800 yards.

(*b*) Demonstrations of the beaten zones at (say) 500, 800 and 1,200 yards, with ball ammunition.

(*c*) Marking the extremes (length and breadth) of beaten zones at (say) 800, 1,200, and 1,500 yards, by flags or fatigue-men.

(*d*) The study of the beaten zone area, and ground in the vicinity with a view to possible observation of fire, and the training of the gunner to "observe" that area rather than a definite aiming mark.

(*e*) The application of fire as a result of observation. Errors in elevation and direction can be assumed and marked by a flag or fatigue-man, representing the centre of the beaten zone or a fringe of the beaten zone observed. Deliberate and quick methods of altering the elevation will be practised.

"B"—*Collective Instruction* :—

"Collective" instruction, off the range, should be carried out on the lines as given in 6 "A" (*e*) above, but with—

(*a*) *Four points of aim.* It may be assumed that one or more beaten zones have been observed and corrections are subsequently made.

(*b*) *Combined Sights, One point of aim.* The depth and width of the combined beaten zone is demonstrated by flags or fatigue-men, and corrections are subsequently made.

(*c*) *One or more points of aim.* It may be assumed that the beaten zone can be observed on ground within about 30 degrees of the target and at about the same range.

7. *Training with Ball Ammunition.*—Endeavour to teach observation of fire against a stop butt on a classification range is of little value. A stop butt permits of a beaten zone of about 2 or 3 yards. Beaten zones may be several hundreds of yards in length in the field.

Observation of fire exercises should be carried out on a *field firing* range whenever possible. (*See* Practice 7, M. G. Course.)

Greater value will accrue from observation practices if results can be telephoned or signalled to the firing point by observers posted under cover in the vicinity of the area engaged. In this connection it must be realised that observation practices form the connecting link between theoretical fire direction and field practices.

8. "*Individual*" *training with Ball Ammunition* [*see* para. 4 (*b*) above].

This training is given during "individual" firing instruction between Part I. M.G. Course and the classification practices of Part II. M.G. Course, and include—

(*a*) Observation of the beaten zone. Ranges 600 to 800 yards (approximately) :—

(i) Flat ground (normal beaten zone, about 400 yards in length).

(ii) From a position having some "command" or against a forward slope. [Beaten zone is reduced. *See* S. S. 192, Part II., Section 5 (2).]

(iii) From a commanding position *and* against a forward slope. (Beaten zone is much reduced.)

Targets should be placed (*a*) on a crest, so that only the lower half of the beaten zone can be seen; (*b*) on ground likely to give observation short but not beyond, and similarly on ground likely to give observation beyond but not short; (*c*) on ground which, owing to small undulations, produces defiladed areas and causes the beaten zone to be patchy, thus making it difficult to pick out the "nucleus." In these exercises the firer searches, with his eyes, the area carefully, picks out the "nucleus" and applies fire.

(*b*) Observation of the beaten zone. Ranges 800 to 1,200 yards. As in (*a*), but the power of the firer to observe his fire may be limited before 1,200 yards is reached, depending on gun position, ground, etc. Individuals not firing can observe more than the firer.

9. *Collective Training* with ball ammunition. (*See* para. 4 (*b*) above.)

This training is given collectively during part III. M.G. Course, and includes—

(*a*) Range 800 to 1,000 yards. Fire unit (4 guns). Separate aiming marks. To teach fire unit commanders to observe four beaten zones. Necessity for longer bursts to give the commander TIME to observe.

(*b*) Range 1,000 to 1,500 yards. Fire unit (4 guns). One aiming mark. To teach the fire unit commander to pick out the nucleus of a *combined* beaten zone, and apply it.

(*c*) Range 1,500 to 2,000 yards. Fire unit (4 guns). To teach the fire unit commander, with the assistance of the Barr and Stroud range taker, to make use of his instrument to observe the fire of the section.

(*d*) Range 1,500 to 2,000 yards. Fire unit (4 guns). To teach the fire unit commander to make use of ground, which is suitable for observation of fire, when no observation of fire on the ground in close vicinity of the target. (*See* para. 6 "B" (*c*) above, and Summary of Lecture Fire Direction III, para. 7.)

(*e*) Range 1,800 yards or over. Machine gun platoon (two sections). To train the platoon commander, section officers and range-takers to observe the fire of the platoon when engaging large areas of ground necessitating TIME to produce effect, and to practise communication arrangements so that subsequent fire orders can be given and acted upon.

LECTURE XVII.

"COVERING FIRE."

May be direct or indirect.

The following rules are applicable to both types of fire:—

(1) Ranges must be known to within 5 per cent.

(2) If the troops fired over are in movement, they must be kept under observation with great care.

(3) Good barrels only may be used.

(4) The mounting must be rigid.

(5) The range of our troops must never exceed 2,000 yards.

Whether fire is direct or indirect, the safety of our own troops always depends upon the height at which the cone of fire passes above their heads, or the distance by which it clears their flank.

The means by which we ensure that the height is sufficient vary according to the method of fire employed.

A lateral safety angle of three degrees has been found sufficient in war.

"DIRECT COVERING FIRE."

1. *Safety Zone Method* (S.S. 192, Part II., p. 77).—Employed on flat ground where no commanding fire positions can be obtained.

The table gives the limits of the safety zone for ranges of 1,500 yards and upwards.

Methods of Application:—

(i) Take range to target.

(ii) Find from the table the near and far limits of the safety zone.

(iii) By means of the range-finder, locate these limits on the ground.

(iv) Support with fire our troops while they are within the safety zone.

(v) When they reach far limit of zone, raise the sights 500 yards and re-lay on target, ceasing fire when our troops pass beyond the latter.

2. *Safety Angle Method*.—The safety angle is the angle between the line of sight to the target and a line from the gun to a point in front of and below the target.

The magnitude of this angle depends on the range to the troops fired over.

If this range is 1,000 yards or under, the angle is 30′.

If this range is over 1,000 yards up to 1,500 yards, the angle is 60′.

If this range is over 1,500 yards up to 2,000 yards, the angle is 90′.

Method of Application.—The angle is applied by means of graticuled field glasses, or a graticuled card.

(i) Align the zero graticule on the target.

(ii) Note the point on the ground where a line through the 30′, 60′ or 90′ graticule cuts the ground, according as the range to our troops is up to 1,000, 1,500 or 2,000 yards respectively. This will be the point to which they can be supported by fire.

(iii) When our troops reach this point, raise the sights 500 yards and re-lay on the target.

Tangent Sight Method.—The angle can also be applied by the gunner with his tangent sight, should the fire controller become a casualty, in this manner :—

(i) Lay on the target with correct range on the sights.

(ii) Run sights up another 300 yards without touching elevating wheel. The line of sight will now indicate the point to which our troops can be supported by fire.

(iii) When this point is reached, raise sights another 200 yards and re-lay on target.

N.B.—Should the sighting elevation now be [illegible] 1,000 yards,

Note: When running up the slide 300x. pick up an A.A.M., this facilitates relaying after stoppage.
Also have A.A.Ms. for traversing if required.
All gun Nos. must know the A.A.Ms.

What running up the T.S.S. 300x. means.

Range.	Angle reqd. mins.	Angle obtd. mins.
800 yards.	30	30
900	30	34
1000	30	39
1100	60	44
1200	60	49
1300	60	54
1400	60	60.
1500	60	66
1600	90	73
1700	90	79
1800	90	87
1900	90	95
2000	90	104

Advantages of tangent sight method.
Can be obtained by firer.
Gradual increase in clearance angle as range increases & therefore closer support.

LECTURE XVIII.

"INDIRECT FIRE."

---

1. Fire directed at a target invisible to man firing the gun.

Is medium to long range fire and nearly always overhead (covering) fire.

Is seldom used with less than four guns under one control.

Is employed—

(i) When direct fire is not possible.

(ii) When to employ the number of guns necessary to give the requisite support, direct fire would be inadvisable owing to impossibility of obtaining the concealment of guns and chain of supply necessary to enable them to continue in action under hostile fire.

If the guns cannot be kept in action they cannot carry out their chief task—support of the infantry.

Therefore it is sometimes advisable to use an "indirect" fire position because this gives the necessary concealment.

Considerations:— In siting a position for indirect fire a position will be sought for which will ensure (a) the guns being controlled, (b) observation of fire obtained (*see* also Summary of Lecture "Observation of Fire") and (c) the movement of our own and hostile troops noted by the M.G. unit commander. If this can be done the accuracy of fire will be equal to that of direct observed fire but the time taken to open fire will be longer.

2. When we have to hit a target it is necessary to elevate the gun through a certain angle, no matter whether the fire is direct or indirect.

This is really a combination of two angles, one of which is that rendered necessary by the range to the target, and the other that rendered necessary by the height at which the target is situated above or below the gun.

When firing direct this latter angle is put on unconsciously by the firer when he aligns his sights on the target.

When firing indirect he cannot see the target, so this angle must be calculated.

The angle rendered necessary by the range to the target is the same for direct and indirect fire.

The angle for the range is called the tangent angle.

The angle for height is called the angle of sight.

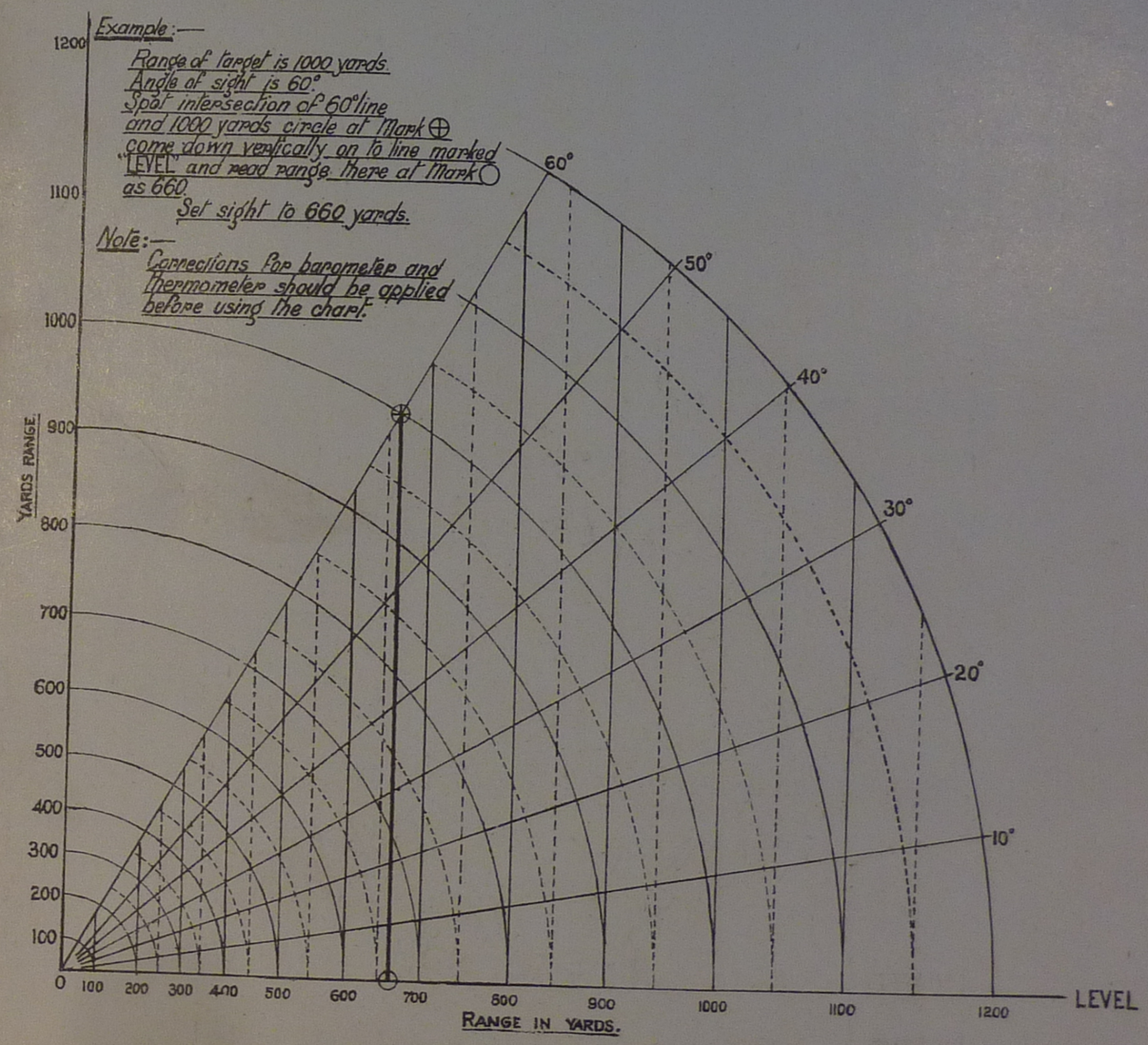
The combination of the two is called the quadrant angle.

Q.A. = T.A. + A.S.

or T.A. − A.S.

according to whether the target is higher than or lower than the gun.

CHART FOR ·303 MARK VII FOR FIRING UP OR DOWN HILL.



lay on me. Swing 31. 20 right,
of 30. Await corrections

Range up and Down Hill

RANGE	10°	20°	30°	40°	50°	60°
200	200	190	180	170	150	110
250	250	240	220	200	180	130
300	290	280	260	240	200	160
350	340	330	300	270	240	190
400	390	380	350	320	270	210
450	440	430	400	360	310	250
500	490	480	450	410	330	280
550	540	530	500	460	400	310
600	590	580	550	500	440	350
650	640	630	590	550	490	400
700	690	670	630	590	530	440
750	740	720	680	630	570	480
800	790	770	730	670	610	520
850	840	820	780	720	650	550
900	890	870	830	770	690	580
950	940	920	870	820	730	620
1000	990	970	920	860	770	660
1050	1040	1020	970	900	820	700
1100	1080	1070	1020	950	860	740
1150	1130	1110	1070	1000	910	780
1200	1180	1160	1120	1050	950	820

LECTURE XIX.

"INDIRECT FIRE T. O. G. METHOD (SHORT BASE)."

---

1. This method of fire is used when no large scale accurately contoured maps are available.

In order to carry this out correctly an O.P. from which the whole of the ground on which the fire is to be directed can be seen + also a gun.

It is essential that the following be available :—

(i) A range finder.

(ii) A compass.

(iii) An angle of sight instrument.

(A director to take the place of (ii) and (iii) would be a great advantage.)

2. Method of application when the guns and observation post are in close proximity to one another.

(*a*) *To obtain direction* :—

(i) Take range O.T. (ii) Measure bearing angle T.O.G. O.P to T, T to G.

(ii) Pace O.G. Find angle O.T.G. OP to G.

(iii) Add together angles T.O.G. and O.T.G. and subtract their sum from 180 deg. The result is the angle O.G.T.

The gun is then laid on O and swung off through O.G.T. degrees.

(*b*) *To obtain elevation* :—

(i) Take angle of sight from O. to T. Range O.T. has already been taken, from which range G.T. can be estimated.

(ii) Find the tangent angle corresponding to range G.T. (Table 1).

(iii) To this angle add A. of S. if positive, subtract if negative.

The result is the Q.A.

Put it on the gun by clinometer.

A fire order is written in the following manner. "Lay on me. (observer) swing .... degrees right (or left). Elevation ... degrees ... minutes. Type of fire - await corrections.

Example. Range to target from O. 1700 x
Paces to gun 150
Bearing to gun 229°
" " target 15°
Angle T.O.G = 146
∠ G.T.O = 2° 30
∠ O.G.T = 180° - (146° - 2° 30') = 31° 30'

Fire Order. Lay on me. Swing 31° 30' left, Elevation 2°. 57'. Fire shoot of 30. Await corrections

LECTURE XX.

"INDIRECT FIRE T.O.G. METHOD (LONG BASE)."

Method of application when the guns and observation post are *not* in close proximity to one another.

(*a*) *To obtain direction* :—

(i) Take ranges O.T. and O.G.

(ii) Measure the angle T.O.G.

(iii) The triangle can now be solved. This is done :—

(*a*) By a field plotter (if available).

(*b*) By drawing it to any convenient scale.

This gives the range G.T. and the angle O.G.T.

The gun is laid on the O.P. and swung off through an angle equal to O.G.T.

(*b*) *To obtain elevation* :—

(i) After taking range O.T., take the A. of S. from O. to T. By. V. I. formula or traversing graph find height of T. above or below O.

(ii) By the same process find the height of G. above or below O.

(iii) From the heights found in (i) and (ii) find the height of T. above or below G.

(iv) Knowing now both the range G.T. and the height of T. above or below G., find from the graph the Q. A.

Put it on the gun by clinometer.

LECTURE XXI.

" INDIRECT FIRE."

MAP METHODS.

The map must be of a scale not less than 1 to 20,000, and contoured at intervals not greater than 10 yards.

The position of the target and of the guns must be accurately marked on the map.

The gun position is fixed on the map—

(*a*) By the aid of local detail ; or

(*b*) By re-section.

1. *Direction.*

Method I.—By map and compass.

A. *On the map :—*

(i) Draw line joining gun to target.
(ii) By protractor find the true bearing of this line.
(iii) Convert this to a magnetic bearing.

B. *On the ground :—*

(i) Put a small peg in the position to be occupied by the gun.

(ii) With the compass placed on the peg lay out the line of fire on the bearing found in (iii) above, and mark it by a post.

(iii) Mount tripod and gun accurately over the peg, and lay the gun on the post.

Method II.—By map and reference object.

A. *On the map :—*

(i) Select a reference object which will be visible from the gun position.

(ii) Join the gun position to the R.O. and to the target.

(iii) By protractor measure the angle between the two lines.

B. *On the ground :—*

(i) The gun having been mounted lay it on the R.O.
(ii) Swing the gun through the angle found in (iii) above.

2. *Elevation.*

A. *On the map :—*

(i) Measure the length of the line joining gun to target, thus finding the range.

(ii) Find the height of target above or below gun by means of the contours.

(iii) Find the Q.A. from the graph.

B. *On the ground :—*

Put on this Q.A. by clinometer.

3. Elevation and direction are then maintained by means of an auxiliary aiming mark.

LECTURE XXII.

"INDIRECT COVERING FIRE."

1. The safety of the troops fired over is ensured by confining to a "safety clearance."

This safety clearance is the minimum height at which the zone of fire must pass above the troops fired over.

It depends upon the distance from the guns to the troops fired over, and is laid down for all distances up to 5,000 yards. (*See* Q.R. graph.)

2. To calculate the height at which the zone of fire will pass above the heads of the troops fired over :—

(i) Let A = height of guns.
(ii) Let B = height of troops fired over.
(iii) Let C = height of trajectory (at distance to our troops) above or below the horizontal plane through the gun position.

Then the clearance = A — B ± C.

If the trajectory (at the distance to our troops) is above the horizontal plane, C is added ; if below, C is subtracted.

Methods of Finding A and B :—

(i) When shooting by the map, mark positions of guns and own troops and find their respective heights from the contours.

(ii) When shooting by the T.O.O. method (long base) take range and angle of sight to troops from the O.P. and work out their height with relation to the O.P. The height of the guns with relation to the O.P. having been also worked out, the height of the troops with relation to the guns can be ascertained.

(iii) When shooting by T.O.O. method (short base) use gradients from O.P.

3. To calculate whether the zone of fire will clear an obstruction :—

(i) If the obstruction is very close. Look through barrel (after gun has been laid) with aid of mirror sights. If obstruction is not visible it will be cleared.

(ii) If obstruction is 100 yards or more from the gun. Set tangent sight (after gun has been laid) to range to obstruction. If line of sight clears obstruction, the zone of fire will.

(iii) If obstruction is not visible from guns (i. e., hidden by nearer obstruction) work out as a clearance problem as in para. 2, substituting "obstruction" for "troops fired over."

LECTURE XXIII.

"SECTION CONTROL I." (Indirect Fire).

---

1. In order that it may be possible to switch the fire of all the guns of a section on to any target as easily as that of a single gun, it is essential that the lines of fire be laid out parallel initially.

The section is then said to be on "parallel zero lines."

2. One of the guns (usually the left gun) of the section is called the "directing gun." When it is required to engage a target, the angle through which the directing gun must be swung in order that it may be laid on its corresponding portion of the target is first ascertained.

All the guns are then swung through this angle, which is called the "angle of switch." The section is then said to be on "parallel lines of fire."

3. If guns fire on parallel lines they will only engage a width of target approximately equal to the frontage of the section.

Most targets have a width considerably greater than that of the section.

The lines of fire must therefore be opened out so that the whole target may be engaged. This process is called "distribution."

The angle through which the gun next to the directing gun must be swung away from the latter in order that its line of fire may be directed on to its corresponding part of the target is called the "angle of distribution."

4. To obtain the angle of distribution :—

(i) Subtract the frontage of the section from that of the target.

(ii) By V.I. formula or traversing graph find what angle this length represents at the range to the target.

(iii) Divide this angle by the number of gun intervals. The result is the angle of distribution.

5. To obtain the target frontage :—

A. When using T.O.G.—short base :—

(i) Find what angle the target subtends at the O. P.

(ii) From this angle and the range find the frontage.

B. When using T.O.G.—long base :—

(i) Using each end of the target as the point T., solve the triangle T.O.G. twice. This will give two values for the angle at G.

(ii) The difference between these two values is the angle subtended at G. by the target.

(iii) From this angle and the range find the frontage.

C. When shooting by map :—

Measure the frontage with a scale.

NOTE.—In this case the target frontage is the frontage as it would be viewed from the section, not its actual length.

LECTURE XXIV.

"SECTION CONTROL II." (Indirect Fire.)

---

1. To obtain parallel zero lines.

A. From the gun positions by compass :—

Lay out the line of fire of each gun separately in the required direction on the same compass bearing.

B. From the gun positions by means of an R.O. :—

(i) The flank guns of the section are laid on each other.

(ii) They are then laid on the R.O.

(iii) The angles swung through by each gun (read on the direction dials) are noted.

(iv) These angles are added together and the result subtracted from 180 deg. The remainder is then divided by the number of gun intervals.

(v) All guns are laid on the R.O. and the angle found in (iv) is used as an angle of distribution.

The guns are then on parallel lines.

NOTE.—Should the R.O. be at a great distance or to a flank in prolongation of the line of guns, it is unnecessary to distribute.

C. From the O.P. by compass or director :—

(i) All guns are laid on the O.P.

(ii) The angle subtended at the O.P. by the section is measured and divided by the number of gun intervals.

(iii) The angle thus found is used as an angle of distribution.
The guns are then on parallel lines.

2. The parallel lines obtained by the above methods may not be in a suitable direction.

All guns should then be swung through the same angle until they are laid in the direction required.

3. When parallel zero lines have been laid out they must be marked by "zero posts." These posts must not be moved.

The lines of fire of guns to any target are marked by auxiliary aiming posts.

LECTURE XXV.

"NIGHT FIRING"

---

1. The following apparatus is necessary :—

Luminous sights.
Night Firing lamp and picket.
Electric torch or lantern.

2. Two distinct cases will arise :—

(a) When the gun can be laid by day on the target to be engaged by night. In this case it is only necessary to arrange for the maintenance of the elevation and direction already put on.

Procedure :—

Before dark.—Lay the gun on the target with the correct sighting elevation.

After dark:—Place the night firing lamp 9¼ yards in front of the socket and in the line of sight, running up the tangent sight to any convenient height, but NOT altering the laying of the gun. Should the gun become deflected during firing from its correct laying it is only necessary to relay on the lamp to ensure correctness of elevation and direction.

(b) When the gun is not in its night firing position before dark.

Procedure :—

Before dark.—Mark the gun position by a peg. Place a post in the correct line of fire 9¼ yards from the gun position. (This is usually done by means of a compass placed on the gun position peg.)

After dark.—Mount the gun accurately over the gun position peg. Place the night-firing lamp and picket on the spot marked by the direction post. Lay for direction on the lamp. Put on the elevation necessary by clinometer. Adjust the tangent sight so as to give a line of sight on to the lamp. Maintain laying as in case (a).

Notes—

(i) An electric torch, or a lantern, is necessary for reading dials, clinometers, etc.

(ii) Should the gun position be visible by day from the enemy lines the flash must be screened by night. This is best effected by means of a screen of canvas or empty sandbags, wetted and hung about a yard in front of the muzzle of the gun.

8GP1—S15—142CGS—27-2-22—500

APPENDIX to ARMY INSTRUCTION (INDIA)

No.682 of 1924

INSTRUCTIONS FOR THE CARE AND USE OF LAMPS AIMING, M.G.

1. Before opening the box, the folding handle of the drum is to be opened out ready for use.This is important as, if the handle is left folded, the cable is liable to be pulled away from the connecting screws of the terminal plates of the lamp.
2. When the lamp is noy in use, care should be exercised to ensure that the switch is left off and quite clear of the "1" & "2"
3. No projecting strands of wire should be allowed to touch any terminal other than that to which they are attached. Particular care should be taken that no exposed wire touches the terminals of the spare coil.
4. The folding handle of the drum should be restored into its slot when the box is closed for travelling.
5. When unwinding the cable it is necessary to unwind both wires together. Speed should not be attempted.The lamps should not be held in the haid but by the wire about a foot from the lamp.Neglec of this precaution may result in the lamp being jerked and the connection carried away should the cable jam on the roller. It is necessary that the man at the box during unwinding should ensure that no loose coil of cable is allowed to loop round the ends of the roller.
6. When winding in the cable the following proceedure is the simplest. The man should hold the body of the box between his knees, turn the handle with his right hand and with his left hand lead the two cables, held as a double cable, regularly across the drum.
7. A hole is left in one side of the box to allow the box being closed when the cable is out and the lamp ready for use.
8. The coil of the adjustable resistance should be kept free from knocks and kept in its seating.
9. The word "Top" on the lamps indicates the position when on the t target post, not when in the box.
10. In placing the cells in position it may be necessary to cut the cardboard edge to give the ebonite securing strip a good seating on the top of the cells.

NIGHT - Firing.

Kit required.

Luminous sights. To be exposed to light for at least one hour before use.
Night firing box with lamp.
Electric torch.
Pickets. i.e. (Auxiliary Aiming Marks.). Iron or wooden.

Night firing box.
This can be made out of the lining of a S.A.A. Box. Turn on one side and cut circular hole on top for ventilation.
On one side punch a series of holes to represent lines. The centre hole being larger than the remainder. One line to run horizontally cut by vertical lines. The box should be placed 9½x. from the gun. As the vertical lines are 1" apart, this gives an angle of 10 mins.

Method of laying guns.
1. When the gun can be layed by day on the target that is going to be engaged by night.
In this case it is only necessary to maintain direction and the elevation that has already been put on.
This is done by the following method:-
By day put out an auxiliary aiming mark9½x. from, and in front of the gun. Get this in line with the target and fix it in position. Run up the sights,(being sure not to alter the laying of the gun which has already been layed to hit the target), until the line of sight cuts the bull on the auxiliary aiming mark.
By night.
Replace auxiliary aiming mark by night firing box, taking care that the centre bull or hole in the night firing box is in the same place as the bull of the auxiliary aiming mark. Thereby giving exact direction.

FIRST WEEK

Period	1st	A	2nd		3rd		B	Remarks
Time	07-00 to 07-45		09-45- to 10-30		10-30 to 11-15			
Monday	E. G. D. 1		G. Desc.	1	Stripp.	1		
Tuesday	E. G. D. 2		G. Desc.	2	Stripp.	2		
Wednesday	E. G. D. 3		G. Desc.	3	A. I.	1		
Thursday								
Friday	E. G. D. 4		Stripp.	3	I. A.	1		
Saturday	E. G. D. 1 to 4		Mech.	1	A. I.	2		

Notes:—

SECOND WEEK

Period	1st	A	2nd		3rd		B	Remarks
Time	07-00 to 07-45		09-45 to 10-30		10-30 to 11-15			
Monday	E. G. D. 5		I. A.	2	C. & C.	1		
Tuesday	E. G. D. 6		G. Desc.	4	B. F.	1		
Wednesday	E. G. D. 1 to 6		Mech.	2	B. D. A.	1		
Thursday								
Friday	E. G. D. 1 to 6		Mech.	2	I. A.	3		
Saturday	Stripp: 4		A. I.	3	C. & C.	2		

Notes:—

THIRD WEEK

Period	1st	A	2nd		3rd		B	Remark
Time	07-00 to 07-45		09-45 to 10-30		10-30 to 11-15			
Monday	E. G. D. 1 to 6		I. A.	4	A. I.	4		
Tuesday	Pack: 1		Mech.	3	R. &A.	1		
Wednesday	E. G. D. 1 to 6		I. A.	5	B. D. A.	2		
Thursday								
Friday	Pack: 2		25 yds.	1	25 yds.	2		
Saturday	E. G. D. 1 to 6		Mech.	3	Mech.	4		

Notes:—

FOURTH WEEK

Period	1st	A	2nd		3rd		B	Remarks
Time	07-00 to 07-45		09-45 to 10-30		10-30 to 11-15			
Monday	T. O. E. T. 1		T. O. E. T.	2	T. O. E. T.	3		
Tuesday	E. G. D. 7		T. O. E. T.	4	T. O. E. T.	5		
Wednesday	Pack: 3		I. A.	6	I. A.	7		
Thursday								
Friday	E. G. D. 7		25 yds.	3	25 yds.	4		
Saturday	E. G. D. 8		Mech.	5	Mech.	5		

Notes:—

FIFTH WEEK

Period	1st		A	2nd		3rd		B	Remarks
Time	07-00 to 07-45			09-45 to 10-30		10-30 to 11-15			
Monday	E. G. D.	9		S. P.	1	I. A.	8		
Tuesday	E. G. D.	10		Mech.	6	B. F.	2		
Wednesday	E. G. D.	11		Mech.	6	I. A.	9		
Thursday									
Friday	E. G. D.	12		25 yds.	5	25 yds.	6		
Saturday	Pack:	4		Mech.	7	R. & A.	2		

Notes:—

SIXTH WEEK

Period	1st		A	2nd		3rd		B	Remarks
Time	07-00 to 07-45			09-45 to 10-30		10-30 to 11-15			
Monday	E. G. D.	12		Mech.	7	S. P.	2		
Tuesday	Pack:	5		Mech.	8	Mech.	9		
Wednesday	E. G. D.	12		Mech.	10	I. A.	9		
Thursday									
Friday	A. G. D.	1		25 yds.	7	25 yds.	8		
Saturday	A. G. D.	1		Mech.	10	B. D. A.	2		

Notes:—

SEVENTH WEEK

Period	1st		A	2nd		3rd		B	Remarks
Time	07-00 to 07-45			09-45 to 10-30		10-30 to 11-15			
Monday	T. O. E. T.	6		Mech.	11	Stop.	1		
Tuesday	A. G. D.	2		Mech.	11	Stop.	2		
Wednesday	Pack:	6		Mech.	5	Stop.	3		
Thursday									
Friday	A. G. D.	2		25 yds.	9	25 yds.	10		
Saturday	Pack:	7		I. A.	9	Stop.	4		

Notes:—

EIGHTH WEEK

Period	1st		A	2nd		3rd		B	Remarks
Time	07-00 to 07-45			09-45 to 10-30		10-30 to 11-15			
Monday	T. O. E. T.	7		Mech.	12	Stop.	5		
Tuesday	Pack:	8		I. A.	9	Stop.	6		
Wednesday	A. G. D.	3		Mech.	13	Stop.	7		
Thursday									
Friday	A. G. D	3		25 yds.	11	25 yds.	12		
Saturday	Pack:	9		Stop.	8	Stop.	9		

Notes:—

Fortnight Refresher. 1st Week.

Day	Periods.			Remarks.
	1st.	2nd.	3rd	
Monday	E. G. D. 1-6	G. Desc. 1-4	Strip 3	
Tuesday	E. G. D. 1–6	A. I. 1	I. A. 6	
Wednesday	E. G D. 7–9	I. A 3	Mech 2	
Thursday				
Friday	E G. D. 10	I. A 9	Mech 3& 6	* 2nd & 3rd periods will require time-09 -00 to 13-00 for 4 teams on 4 gun range.
Saturday	T. O.E. T. 1	25 yds *3	25 yds *5	

Fortnight Refresher. 2nd Week.

Day.	Periods.			Remarks
	1st	2rd	3rd	
Monday	†T. O. F. T. 2&4	Mech. 4.	Pack 1–4	
Tuesday	†T. O. E. T. 2 & 4	25 yds. 9	25 yds. 11	25 yds 9 & 11 practice cut down. These 2 practices will require time -09-00 to 13-00
Wednesday	A. G. D.2	Mech. 7 and 8	Stop 9	
Thursday				
Friday	A. G. D. 5	Mech 9	Pack 8	†Each pair get a trial run before their test: after first pairs trial run, both will be going on at the same time.
Saturday	A G. D. 5	Mech 11	Stop 9.	

In I. A. Mech. and Stop. periods, time will not permit of each man going through the whole lesson as in instruction of recruits: the instructor will run through the whole lesson, and the men in turn detail a portion each.

Vickers Gun Training Programme.

Working Day.	A. M. 6 15 7 15	A. M. 7 50 8 50	A. M. 9 00 10 00	A M. 10 00 10 45	A. M. 10 45 11 00	A. M. 11 00 11 45	A. M. 11 45 P. M. 12 15	P. M. 12 20 1 35	P. M. 1 50 2 50	P. M. 2 50 3 50	Remarks.
1st day ...	Elementary Gun Drill, (E. G. D.) Section 18, paras. 1—8. (*a*)	Breakfasts ...	General Description, (G. D.) Non-recoiling portions, Pages 8—18. (*b*)	Mechanism, Sequences 1—3, Section IV. (*b*)	Break ...	Stripping Gun. Section VI. (*b*)	Aiming Instructions, Section 17, paras. 1—7. (*a*)	Dinners ...	Imediate Action, (I. A.) General and 1st Position, Section IX. (*b*)	Care and Cleaning, (C. C.) Section V. (*b*)	Text books to be used :—
2nd day ...	Ditto ...	Ditto ...	Ditto ...	Ditto, Sequences 4 and 5.	Ditto ..	General Description, Recoiling Portions, Section III, Pages 18—21. (*b*)	Ditto paras. 8—10. (*a*)	Ditto ..	Ditto 2nd Position.	Belt Filling Demonstration and Practice.	(*a*) Machine Gun Training, 1921 (Prov.)
3rd day ...	Rifle Range "C," Table "B," Part I, Practices 1 and 2. (*c*)	Ditto ...	Elementary Gun Drill, Section 18, Paras. 9—16. (*a*)	Ditto, Sequences 6 and 7.	Ditto ...	Stripping Lock, Section VI. (*b*)	Immediate Action, 3rd Position, Section IX. (*b*).	Ditto ...	Rifle Range "C," Annual Machine Gun Course, Pt. 1, Practices 1 and 2. (*a*)		(*b*) Handbook of the Vickers Gun 1918.
4th day ...	Ditto, Practices 3 and 4.	Ditto ...	Ditto, Section 18, Paras. 17—19. (*a*)	Ditto, Sequences 8 and 9.	Ditto ..	Ditto ...	Ditto 3rd and 4th Position. (*b*)	Ditto ..	Ditto	Pt. I, Practices 3—5	(*c*) Auxiliary Force, (India) Musketry Courses (1922) 9351-C., G. S.-M. T. I.
5th day ...	Ditto, Practices 5 and 6	Ditto	Range C, Annual Machine Gun Course, Part I, Practice 6. (*a*)	Ditto, Sequences 10—12.	Ditto ...	General Description, Recoiling Portions, Section III, pages 18—21. (*b*)	Stoppages, (S.) 1st and 2nd Position, Section X. (*b*)	Ditto ..	Rifle Range "A," Pt. II, Practices 8—10.		
6th day ...	Ditto, Practices 7 and 8.	Ditto ...	Elementary Gun Drill, Section 18, Para. 21. (*a*)	Ditto, Sequences 13—14.	Ditto ...	General Description, Feed Block and tripod, Section III, Pages 21 and 24—26. (*b*)	Stoppages, 3rd and 4th Position, Section X. (*b*)	Ditto ..	Ditto Pt. II, Practices 11—14.		
7th day ...	Ditto, Practices 9 and 10.	Ditto ..	Test of Elementary Training, (T O. E. T.) Section 18 (*i*) to (*v*) inclusive. (*a*)	Points B, D and A Firing, Section VII. (*b*)	Ditto ...	Spare parts, (S. P.) Section VIII. (*b*)	Care and Cleaning, Section V. (*b*)	Ditto ...	Free for Sports		
8th day ...	.....	Ditto .	Church Parade ...	.....	.....	.....	.....	Ditto ...	.....		

F. RUSSELL, *Captain*,

Regimental Adjutant, E. I. Ry. Regt., A. F., I.

"LARGE" L. A. & M. G. TARGET

No. 5. Targets for the Annual Machine Gun Course.

The following extract from India Army Orders, dated 29th March 1924, is published for information :—

"*No. 250. Targets for the Annual Machine Gun Course.*—Reference India Army Order No. 169 of 1924. It has come to notice that certain units are outlining the target used in practice 14 with white or grey paper. It is pointed out that on no account may this target be outlined in this manner. The only alteration that may be made to the target to obviate visual difficulties is that given in the India Army Order quoted above."

VICKERS GUN INFORMATION.

[QUESTIONS AND ANSWERS]

MACHINE GUN SCHOOL
AHMEDNAGAR.

VICKERS GUN INFORMATION.

No.	Subject.	Nature of query or point raised.	Answer by Commandant.	Reference.
1	A. M. G. Course allotment of 900 rounds	How is course to be modified to suit?	See Col: 5.	I. A. O. 603 of 1922.
2	Loss of Empties.	What percentage of loss is allowed for V. G. Units?	None. All fired cases must be accounted for: a loss statement is necessary for all deficiencies.	A. R. I. Vol. II para 783 A. R. I. Vol. III ,, 61
3	Ammunition Reserve.	What is amount per gun?	With gun / Regtl. Res. / Amm: Col. Inf. 5000 / 3000 / 5000 Cav. 3000 / 8000 / 9000 Arm Cars. 5000 / 7000 / 3000	Letter No. 9786 S. D. 1 of 23-7-21.
4	Nickelling.	Complaints regarding excessive metallic fouling.	A. H. Q. fully aware of this; action being taken. Comparative trials now in hand between S. A. A. manufactured in India and at Home	
5	Charger V. G. Officer.	Is the V. G. Officer of an Infantry unit entitled to a charger?	Yes.	A. I. I. 767 of 1922.
6	Clippers.	Any prospect of adequate issue of hand clippers, or issue of clipping machines?	No immediate prospect of increasing existing scales of issue.	A. I. I. 323 of 1922.
7	Cav: V. G. Troop Drill.	Objections to drill in force vide letter No. 11742/1 S. D. 1. and 11720/1 S. D. 1.	A revised drill and organisation has been issued.	A. H. Q. letter No. 11720/2 S. D. 1. 11742/2 S. D. 1 dated 13-11-22
8	V. G, Ceremonial Drill.	Will Comdt: issue a provisional ceremonial drill for Infy:	See Col: 5.	Infantry training Vol. 1 1922.
9	Pack Drill.	Can a pack drill be issued giving detailed instructions for each member of section from fitting of saddlery to "action" & comprising a manoeuvre drill.	In view of the early issue of the new modified Home pattern equipment to all infantry units in India, nothing beyond the instructions contained in letter No. 10618-4 (S. D. 2) at present. A pamphlet containing a complete pack drill, load tables, instructions for loading, and use of gear, & extracts from equipment tables will be issued simultaneously with the new equipment.	
10	V. G, Ready loaded on pack.	Ref. suggestion of Comdt. M. G. S. has anything been decided?	No. Commandant M. G, S, awaits practical suggestions from units, particularly those on frontier.	
11	"Section"	"Section" in infantry means $\frac{1}{4}$ of platoon. Comdt. M. G. S. states that as regards M. G's it means a V. G. Unit of 4 guns. Can a definite ruling be given?	War Office have ruled that a section comprises 4 guns and a subsection 2 guns.	A H. Q. 13595-M. T. 1 dated 10, 10; 22.

No.	Subject.	Nature of query or point raised.	Answer by Commandant.	Reference.
12	Indian Cavalry V. G. equipment Regs.	Regs for equipment I. A. part 2 does not agree with I. A. O 1319 of 1921.	Being amended	
13	V. G. expendible stores.	Great difficulty experienced owing to Arsenals insisting on return	See Col. 5	A. I. I. 522 of 1922. Appendix.
14	V. G. Stores.	What is authority on which to demand ?	See Col. 5	A. I. I. 522 of 1922. Appendix.
15	(A) Handguards (B) Gloves M. G's	Which is issue, or are both ?	(A) Handguards only. (B) Only as a temporary measure pending handguards becoming available.	(A) Item 59 I. A. O. 1319 of 1921. (B) I. A. O. 204 of 1922.
16	"Trench Covers"	Suggest issue of canvas covers for guns.	Has been taken up by A. H. Q.	
17	Auxiliary Mounting.	Is there any prospect of issue for M. W ?	(A) No. It has been decided that this mounting is not suitable for mountain war-fare. (B) It has been declared obsolete in the Home service.	
18	End Cover.	Is this a part of V. G. Stores ?	Obsolete.	I. L. C. 10999.
19	Condenser Bag.	What is Official name for indenting purposes.	Bags waterproof canvas.	I. L. C. 10933.
20	Tool belt repairing	Can this be reissued ?	Will be reissued.	I. A. O 538 of 1922.
21	(A) Plasticine. (B) Luting.	Are these an issue ?	Luting only is now used for local repairs.	I. L. C. 10412.
22	Revolvers.	Is an I. O. of Indian platoon of British Regt. armed with a revolver ?	A revolver is part of every combatant Indian Officer's outfit.	
23	Binoculars.	What is establishment ?	It is left to discretion of O. C. how these are distributed.	A. I. I. 677 of 1922.
24	Directors.	Some units have these; will they become an issue ?	Units having these will return them to the Arsenal on which dependent.	I. A. O. 21 of 1922.
25	Clinometers.	Are these an issue, or will they be issued ?	They are an issue to a scale of 1 per Vickers Gun Platoon [i. e. unit].	I. A. O. 538 of 1922

No.	Subject.	Nature of query or point raised.	Answer by Commandant.	Reference.
26	Capes M Gunners	Can these be obtained ?	Yes.	I. A. O. 967 of 1917
27	Bar foresight	Is this to be an issue ?	Yes, under order from Home.	
28	N. F. Lamp	Is the lamp shown on page 311 of M. G. T. 21 to be an issue ?	This or later pattern when financial situation permits.	
29	Condenser.	(A) What is new pattern, ? (B) When to be issued ? (C) What is plug test adapter ?	(A) Col. 5 (B) As existing pattern becomes unserviceable. (C) Col. 5	I. L. C. 10933 I. L. C. 9062 I. L. C. 10933
30	T. Bases.	(A) Is their use. (1) Admissable on the range ? (2) Recommended on service. ? (B) Are they to be an issue. ?	(A) Yes. [1] See M. G. T. p. 99 Sect. 34 para 1 [ii] & para 3. [2] When it is possible to carry them and tactical conditions allow their use, or particularly when indirect fire is required. (B) Under consideration.	
31	Carriers belt box.	Are these an issue. ?	Yes. See Col. 5	Item 58 I. A.O. 1319 of 1921
32	Worn Belts.	Suggested that good portions could be joined and used for drill purposes to save wear on service belts.	Sanctioned and an A. I. I. will be issued shortly.	Letter No. 26329/5/0 dated 10th June S. C. to P. D.
33	Spare parts boxes.	What is the scale. ?	One per gun are being issued, spare parts to be divided and with additions make both boxes equal.	A. H. Q. No. 35033/Q. 11-B dated 7-7-22.
34	Cleaning material.	Can an issue be authorised for V. G's. ?	Col. 5	A. I. I. 522 of 1922 appendix.
35	D. P. Guns & Locks.	Can these be issued. ?	(A) Guns under consideration. (B) Locks See Col. 5	(A) A. H. Q. Letter No. 35033 Q 11-B dated 27-1-22 (B) I L. C. 10885
36	(A) Skeleton Guns. (B) Skeleton Locks. (Item 37 deleted)	Issue of.	(A) & [B] Policy is to issue D. P. for stripping and not skeleton. (B) Re-issue of the obsolete "lock skeleton brass" under consideration,	See item 71.

No.	Subject.	Nature of query or point raised.	Answer by Commandant.	Reference.
38	Indian Cavalry limbers.	Are limbers part of V. G. equipment of Indian Cavalry ?	They are not.	
39	Indian Cavalry Home pattern equipment.	When will this be received?	Orders to issue are now being given.	
40	Cavalry V. G; Pack gear.	Pads unsatisfactory.	Referred Home & reply received that modification has been approved which eliminates the defect in question. India will follow suit on receipt of para W. O. L. C.	
41	Top Load Strap.	Should this be issued to units as part of Mk. II saddle.	A strap 1" x 38" forms part of the Mark II saddle for this purpose and the saddle should be complete with this strap when issued. The existing Mark II saddle [I. L. C. 7250] is nothing more nor less than the Mark I ammunition saddle [I. L. C. 4296] of the old maxim gun equipment which has been modified to make it suitable for the carriage of the gun & mounting or ammunition and a strap 1" x 38" was made a part of this saddle for securing the top load by Errata on page 73 of I. L. C's. dated the 31st March 1904.	
42	Baggage straps	What is their use ?	For purposes outside the ordinary carrying of V. G. Loads such as fetching of forage, ammunition etc from dumps to lines. Ropes baggage will be issued in future in lieu for this purpose.	
43	Saddle rooms.	Can provision be made for accommodation of V. G. saddlery in Inf. Lines ?	Funds are not available at present for this purpose: existing accommodation must be made to do.	
44	V. G. Drivers British Infy:	What is the precise position regarding. [A] Enlistment. [B] Training.	The conditions in regard to enrolment and training are contained in letter Nos A 10740/1/A. G. 6 dated 6-4-22 and A 10740/2/A. G. 5 dated 28-4-22.	
45	Garhwali and Kumaoni V. G. Drivers British Infantry.	What is authority for obtaining items of dress particular to these classes ?	Garhwali and Kumaoni V. G. Drivers attached to British Infantry units should for purposes of clothing be treated in the same way as Garhwal or Kumaoni Infantry Soldiers vide para I of A. I. I. No. 658 of 1921. The special items of clothing for them i. e. trousers frock and felt hat can be obtained on the authority of clothing regulations vide notes against "Blouse" Knicker bockers and "Puggri" in Table III.	

No.	Subject.	Nature of query or point raised.	Answer by Commandant.	Reference.
46	Indian Coy. in British Infy:	Who Commands it?	The question as to who commands the Indian Coy. is now under consideration and is under reference to commands and units for opinions. It is hoped that it will be decided by the time the peace establishment of a British Infy. Bn. is issued in its new form.	
47	Drivers allowance.	Is this admissible as for L. G. Drivers?	See Col. 5	They are entitled to the drivers allowance referred to in accordance with A. I. I. 470 of 1922.
48	Signallers.	Can V. G. Platoon establishment be increased to include sigrs?	No. Must be provided from the Regtl. establishment.	
49	V. G. Peace Estab: Indian Infy:	No. B. O. or I. O. shown though one of each in war establishment.	See new peace establishment.	
50	Cav. V. G. Estab:	Can personnel be increased as now inadequate?	Cannot be considered.	
51	Armourers.	[A] Some armourers do not understand V. G's. [B] Some have not tools for reparing V. G's.	(A) I. A. O. 164 of 1920 authorises instruction in Arsenals of all Armourers. [B] The Armourer's tool box and the articles in spare parts box are sufficient for this work,	
52	Proficiency pay.	Can V. G. personnel qualify for Prof. Pay on results of A. M. G. C.	In hands of Commanding Officers. An I. A. O. is under issue laying down Standards.	I. A. O. 663 of 1922
53	Gun Commander.	Is a "Gun Commander" part of the organisation of a gun Team.	See Col. 5.	M G.T, 1921 p. 35 Sec: I6
54	Springs Gib " Lock	Why Gib 2 and Lock 1 instead of as in Handbook.	Indian scale. Lock springs are now being increased to 2 per wallet.	
55	Spare parts.	Cannot obtain from Arsenals.	Due to shortage in India.	
56	Brigading Machine Guns.	What is policy?	Subject to discretion of G. O. C.	

No.	Subject.	Nature of query or point raised.	Answer by Commandant.	Reference.
57	Instruction in Barr & Stroud.	Can this be given at M. G. S. ?	Elementary instruction in one man range finder is now given as part of M. G Course to all British Ranks and to I. O.'s. Instruction comprises [A] How to take a range. [B] How to adjust.	
	[Item 58 deleted]			
59	Auxiliary Force A. M G. Course.	What is correct course for Aux. Force. ?	(A) For guns on estab of units.— Regular Courses as modified: See Col. 5. (B) For guns in defensive posts, course as laid down: See col. 5.	(A) I. A, O. 603 of 1922 (B) I. A, O. 581 of 1920
60	A.M.G. Course returns	How dealt with by units.	[A] Summary to M. G. S Ahmednagar [copy to M. G. S. England, British Units.] [B] A. F. B. 192 M to District or same channel as Musketry returns.	
61	Firing up & down hill,	What is the decrease in elevation necessary for various ranges at various angles above or below 10 degrees.	Commandant M. G. S. now has a graph and table in process of printing.	
62	Triangle of error	Has this been re-introduced ?	No. Does not exist.	
63	Revolver Course	[1] Who fires a course ? [2] What course is fired ?	[1] All personnel armed with a revolver, [2] Annual course for this weapon.	(1) A. H Q. No. 8340 M. T. I. 6-7-22 (2) Vide Add. 3 to M. R. Pt.; I.
64	Musketry	What Musketry course are V. G. personnel required to fire Ref. I. A. O. 435 & M. G. T. p. 18. ?	Note 2 Table B. M. R. I. S. Addendum 2 April 1922.	
65	Machine Gunners sliding graph	Is this to be an issue ?	Not at present. The question of issue of an improved type suitable for mountain as well as normal warfare is under consideration.	
66	Vernacular Text Books	When can supply of these be expected ?	Shortly.	
67	History Sheets	Are these to be kept up ?	[A] Obsolete. [B] Monthly report on 0-1454 A.	(A) Oct append I A O. 1920 (B) A R I Vol. II para 850

No.	Subject.	Nature of query or point raised.	Answer by Commandant.	Reference.
68	Arming of Aux : Force	Is there any prospect of Aux : Force getting Vickers Guns. ?	Will be armed with Vickers Guns as soon as regular units completed to scale.	
69	Internal defence British Infantry	Of the 8 guns it is understood that 4 proceed on service and 4 on internal defence, do the latter 4 remain at the Regiment's station or to the forward depot.?	Remain at Battalion's station.	C. G. S. letter 1346 S.D. 2 dated 10-10-22
70	Coloured diagrams	Issue urgently needed.	A quantity have been ordered from England.	
71	Instructional. Locks	What do various terms mean.?	"Lock instructional D. P." is a service lock which has been made suitable for stripping purposes. " Lock skeleton instructional " is a service lock skeletonised to show interior components. " Lock skeleton brass " is a rough model made of a piece of brass with two edges turned up and interior components on one side.	 see item 36.

AHMEDNAGAR
1st March 1923.

Issued by Commandant,

MACHINE GUN SCHOOL,

Ahmednagar.

No. 26. Machine Gun Training.

The following extract from Army Orders, dated 29th February 1924, is published for information :—

"No. 83. Machine Gun Training (Provisional) 1921—Amendments—1.

Page 97, paragraph 11. *For* sub-paragraph (*a*) *substitute*—

"(*a*) By actual measurement to ensure—

(*i*) that a blue pencil line has been marked correctly on the large (6 ft.) L. A. and M. G. targets; this line to be 6 inches from the edge of the target all round;

(*ii*) that the vertical lines on the L. A. and M. G. screens are marked correctly;

(*iii*) that the outside measurements of all targets are correct and that the targets are sufficiently clear to enable holes easily to be distinguished."

2. Page 112, column 3. Opposite practice No. 5, *For* "Fig. 4" *substitute* "Fig. 3."

3. Page 113, column 3—

(*a*) Oppoiste Practice No. 9. *For* detail *substitute* "Large (6 ft.) L. A. and M. G. target."

(*b*) Opposite Practice No. 10. *Add* "comprising 2 L. A. and M. G. screens, 3 ft. by 10 ft."

No. 26. Machine Gun Training.

The following extract from Army Orders, dated 29th February 1924, is published for information :—

"No. 83. Machine Gun Training (Provisional) 1921—Amendments—1.

Page 97, paragraph 11. *For* sub-paragraph (*a*) *substitute*—

"(*a*) By actual measurement to ensure—

(*i*) that a blue pencil line has been marked correctly on the large (6 ft.) L. A. and M. G. targets; this line to be 6 inches from the edge of the target all round;

(*ii*) that the vertical lines on the L. A. and M. G. screens are marked correctly;

(*iii*) that the outside measurements of all targets are correct and that the targets are sufficiently clear to enable holes easily to be distinguished."

2. Page 112, column 3. Opposite practice No. 5, *For* "Fig. 4" *substitute* "Fig. 3."

3. Page 113, column 3—

(*c*) Opposite Practice No. 12. *For* detail *substitute* "Large (6 ft.) L. A. and M. G. Target."

(*d*) Opposite Practice No. 13. *Add* "comprising 3 L. A. and M. G. screens, 3 ft. by 10 ft."

4. Page 114, column 3. Opposite Practice No. 17. *Add* "comprising 4 L. A. and M. G. screens, 3 ft. by 10 ft."

5. Page 116, Section 38, part I, *delete* lines 8 to 12.

6. Page 116, Section 38 Part II, *delete* from line 1 to line 13 and *substitute*—

"Practice 9. Application 400 yards. Is fired at the large (6 ft.) L. A. and M. G. target. A blue pencil line will be marked 6 inches from the edge of this target all round. For this practice only shots within the resultant 5-foot square will count.

Practice 10. Traversing 400 yards.—Two L. A. and M. G. screens. Each screen is divided into six equal spaces by five vertical lines ruled 20 inches apart."

7. Plate XVIII. *Delete* figures 4 and 5.

8. Page 117—

Practice 13. *Delete* from "Three" in line 1 to "high" in line 2 and *substitute* "Three L. A. and M. G. screens."

Delete lines 3 and 4.

Practice 17. *Delete* from "four" in line 1 to "high" in line 2 and *substitute* "Four L. A. and M. G. screens."

This manual has been scanned by the

Vickers MG Collection & Research Association

www.vickersmg.org.uk

Please support the work of the Association.

Click on the image to donate through PayPal:

Or regularly support us through Patreon:

A not-for-profit company, limited by guarantee, registered in England, Company Registration Number 07855202